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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Heavy Plain Milling Machine.

The engravings represent a new machine, brought out by C. E. Lipe, Syracuse, N. Y.

The base column and head of this machine are the same as in the Universal Milling Machine, described in the AMERICAN MACHINIST, June 10th, 1882. The circular top knee or bracket, with turn-table cap, is replaced in the present machine with a larger and heavier knee of rectangular form. The bearings for the table extend outward on either side, their total length being 36″.

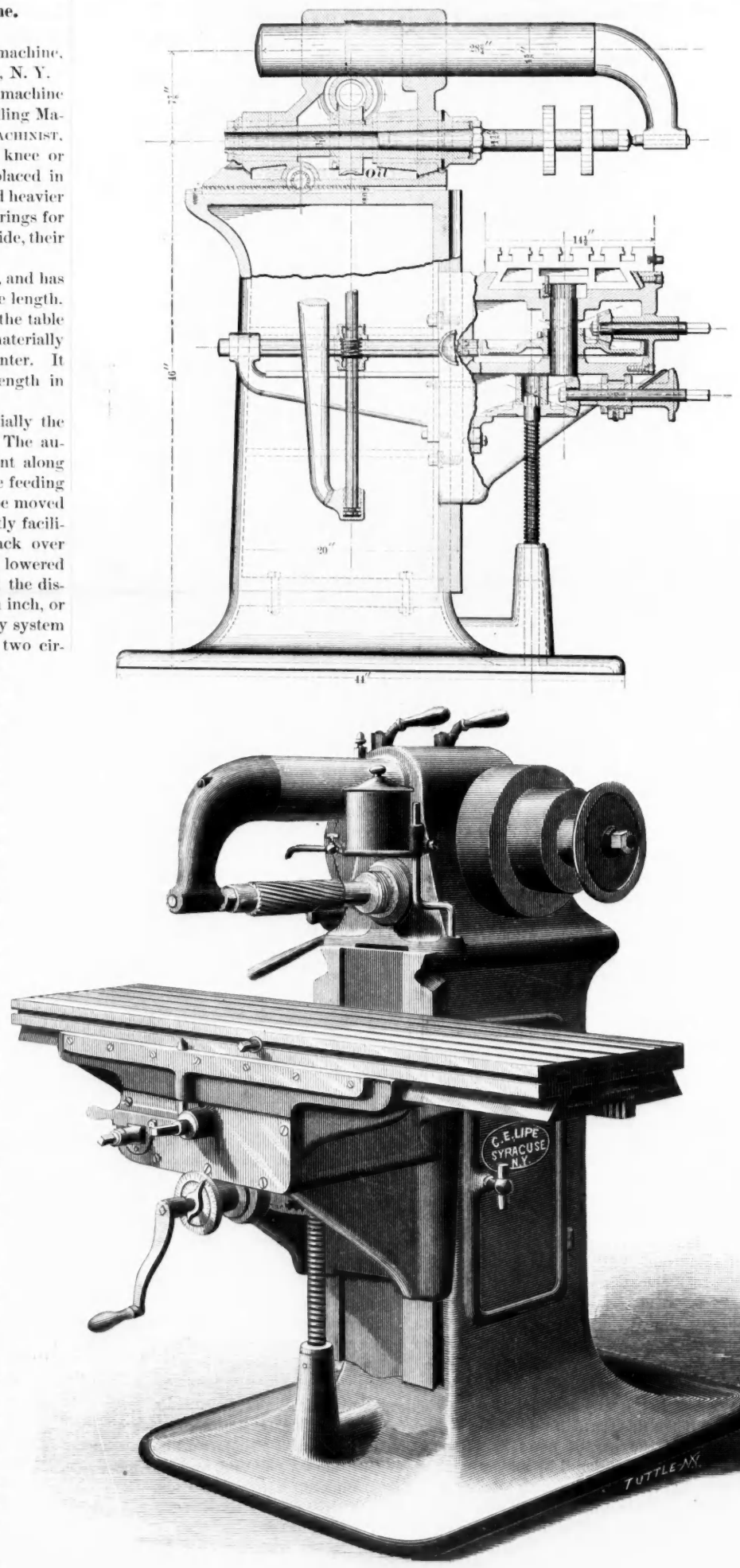
The table is 5 feet long, 14½″ wide, and has 5 T slots for bolts, running its entire length. The otherwise excessive weight of the table is considerably reduced, without materially weakening it, by coring out the center. It has an automatic feed its entire length in either direction.

The feed mechanism is substantially the same as in the universal machine. The automatic stop can be set at any point along the table, and operates with the table feeding in either direction. The table can be moved rapidly with the crank, which greatly facilitates setting work and passing back over long cuts. The knee is raised and lowered with a screw and bevel gears, and the distance measured to thousandths of an inch, or by the more commonly used binary system of 8ths, 16ths, &c., the dial having two circles properly divided for this purpose. The column is of the usual hollow form, with shelves for tools, &c. The adjustment of the cutters to the work in line with the spindle is effected by mounting the head with its spindle, bearings and feed mechanism on top of the column on flat ways, all suitably gibbed on the dovetail plan. A rack and pinion movement governed by a ratchet lever on the side of the head is used to locate the head and cutters.

The cone pulley on the machine has three steps for a 3″ belt, and the counter-shaft is fitted with two pairs of tight and loose pulleys, the ratio of the diameters being such as to give six properly graded changes of speed when both drivers on the line shaft are of equal size. The driving mechanism is a worm and gear enclosed in the head and dipping in oil to ensure perfect lubrication. By reference to the sectional views it will be seen that the drip from all the bearings is caught in pockets and returned to the inside. This arrangement works so satisfactorily that after once filling the head to the proper level the oiling of the bearings serves to maintain a constant supply to the chamber.

The internal construction of both head and knee is clearly shown in the sectional views. On page 2 is a transverse section of the head through the center of the cone-shaft, and on this page is in part a vertical section of the head through the spindle and partly elevation and section on different planes through column and knee.

The bearings for the spindle are solid bushes slightly tapered and



HEAVY PLAIN MILLING MACHINE.

driven into the head from each end against the flanges.

The spindle is of tool steel 3½″ diameter at the front bearing, tapering uniformly ¾ of an inch per foot to the back end. This simple construction allows the spindle to be perfectly ground, and accurately fitted to the boxes by scraping. After this is done the spindle is withdrawn about the $\frac{1}{100}$ part of an inch, and a flat babbitt metal washer fitted to exactly the space between the shoulder on the spindle and the front box. A check nut and sliding collar on the back end holds the spindle in place. A perfectly uniform space for oil is thus formed between the spindle and bearings. The worm gear is forced tightly on the taper spindle with a nut, and keyed to prevent turning.

The spindle has a hole $1\frac{9}{16}$″ through its center, which tapers at the front to receive the arbor to $1\frac{7}{8}$″. This taper is made ½″ per foot, and for all ordinary work is sufficient to keep the arbor from turning, but for driving gangs or large mills an arbor is used having a hexagon enlargement just outside the spindle. A cap to screw over the end of the spindle having a hexagon opening in it to fit the arbor, completes a positive driver that has none of the objections to cutting a mortise or keyway in the spindle or otherwise disfiguring it. This cap protects the thread on the spindle, and may be readily removed for a face-plate or large facing mills.

The cone-shaft and its bearings are made independent of the head. A long sleeve provided with a large flange projects through cored openings in the side of the head. The bosses around these openings are faced off square and parallel, and a large flat ring threaded on the end of the sleeve draws the flange against the opposite face. The large end of the sleeve is counterbored to receive the worm, and is cut away on the under side to allow the worm to drop into mesh with the gear. The worm is feathered on the shaft, the thrust of the worm being taken in one direction against the shoulder in the sleeve, and in the opposite direction (the machine can be driven either right or left-handed) against the end of a bush, which is screwed in the sleeve and forms one bearing for the cone-shaft. Friction washers are placed to form the step, and all wear or lost motion can be removed by screwing in the bearing, which, when adjusted, is prevented from turning by a small set screw. The cone-shaft bearings are babbitt lined, but the spindle bearings are made of cast iron, in which steel scrap has been melted. The worm gear has 40 teeth, and the worm is triple threaded, thus making a back gear equivalent to $\frac{40}{3}$, or 13⅓ to 1. As the sleeve does not fit the openings in the head, the worm and gear may be readily adjusted to each other at all times, and held firmly and squarely in place by drawing the flange tight against the side of the head. Set screws through the head prevent accidental displacement of the sleeve after being ad-

justed. The feed motion is taken from a leather-covered friction disk, secured to the cone-shaft. A vertical shaft, journaled in a bracket secured to the head, and carrying a small friction pinion adjustable at any point on either side of the center of the disk, imparts motion, through a connecting worm and gear, to a horizontal shaft, supported by the knee. Both shafts are splined, and the box inclosing the worm and gear being free to slide on either, both knee and head may be moved independently of the other, without affecting their connection. The horizontal shaft, by means of a hand-wheel and eccentric pin working in a groove in the shaft, can be thrown into gear with another shaft in the same axial line, the two ends being provided with clutch teeth. This shaft carries a worm that engages with the large gear inside the knee-box. The shaft to which this gear is secured projects upward through its bearing, the projection being a pinion that engages with a rack secured to the under side of the table. A bevel gear of smaller diameter is cut on the upper side of the worm gear, and engages with a pinion on the shaft that projects through the box to the front of the machine, where it is squared to fit the handle for giving the table a rapid motion when required. To operate this movement the large gear in the knee must be out of contact with the worm, and provision is made for this release by sliding the front end of the worm shaft away from the gear. To this release is also attached the automatic trip shown in the front of the cut.

The net weight of the machine is about three thousand pounds.

Extracts from Chordal's Letters.

DECADENCE OF SKILL AMONG MECHANICS—BENEFIT OF LEARNING A TRADE IN A SHOP WITH SCANTY APPLIANCES—HOW A GERMAN MACHINIST MADE A RIVET—FINISHING A CRANK ON A LATHE OR BY HAND—HENRY MAUDSLEY'S IMPROVEMENT OF MACHINE TOOLS—UNIVERSAL MECHANICS A USEFUL CLASS—HOW BRAMAH AND MAUDSLEY IMPROVED THE HYDROSTATIC PRESS.

Mr. Editor:

* * * We hear more and more every day regarding the decadence of skill among mechanics. We read more about it in the daily papers than we do in the mechanical papers, and it strikes me that a class who know nothing of the matter is the class best calculated to judge in the matter. This sounds wrong, but I guess it is all right in regard to many things. If you want to find out whether there are any skilled mechanics in a machine shop, all you have to do is to go through the shop, and catechise the men in it; then you will know nothing at all about it. Inquire of the higher powers, men who hire this skill and pay for it, and probably the surface expression will be that "the skill is all right, but the trouble is to find first-class foremen, and such men as that; men with wit and common sense, and push, and everything of that kind."

* * * But there is, Mr. Editor, a lamentable lack of skill in the machine trade, and in other trades at present. There are skilled men, and lots of them, but they are fearfully out of proportion to the number of workmen engaged. We have many mechanical substitutes for skill nowadays, and many of the lost arts have become useless and undesirable, but there always exists a necessity for a class of workmen who, without regard to the amount of common-sense they have, without regard to their general intelligence, to their knowledge of the laws of physics, or of mechanism, can go to work, and do work; and by "do" I mean the biggest kind of a do; not "do" as to quantity, nor "do" as to an ingenious method providing impossible facilities are to be had, but real genuine, every-day, earnest, old-fashioned "do."

* * * A man comes to you and wants a job. You catechise as follows:

Q.—What are you?

A.—Machinist.

Q.—Are you a good one?

A.—Good a one as there is on earth.

Q.—Where have you worked?

The answer is complete. You take this man and put him at a vise, and bring him forgings to work upon. He soon shows that he has a job he don't know anything about. You ask him what the matter is, and he says he never has done that kind of work before. You ask him what he means by "that kind," and ask him if that ain't vise work; you also ask him why he should be particular what kind of vise work he undertakes so long as he is a machinist, and then he gives you his experience on vise work, and you find that he has never taken an eighth of an inch off of anything in his life; he has simply finished up machine-cut surfaces. He cannot take a set of engine link forgings rough from the forge, and fit them up. This is not a question of experience or lack of experience; it is a genuine lack of skill in genuine work. There is a great deal of this sort of thing among our present machinists. I think the main trouble is that most of them have graduated from shops that were entirely too well fixed in the way of tools. I have always believed that our young machinist would be much better off if he could be put back into shops of many years ago to serve his time. He would be no worse off when put into the splendid shop of the present day. With most of our machinists of to-day there is an irksomeness about good hard work, if they happen to be aware of some easier manner of doing it not at their present disposal. There is a good market all the time for the good old genuine cold-chisel workman—men who know how to chip and file. When it comes to the scientific alignment of things, and the getting of things down to a close figure, they get left, but it is very easy to find the nimbler fingers.

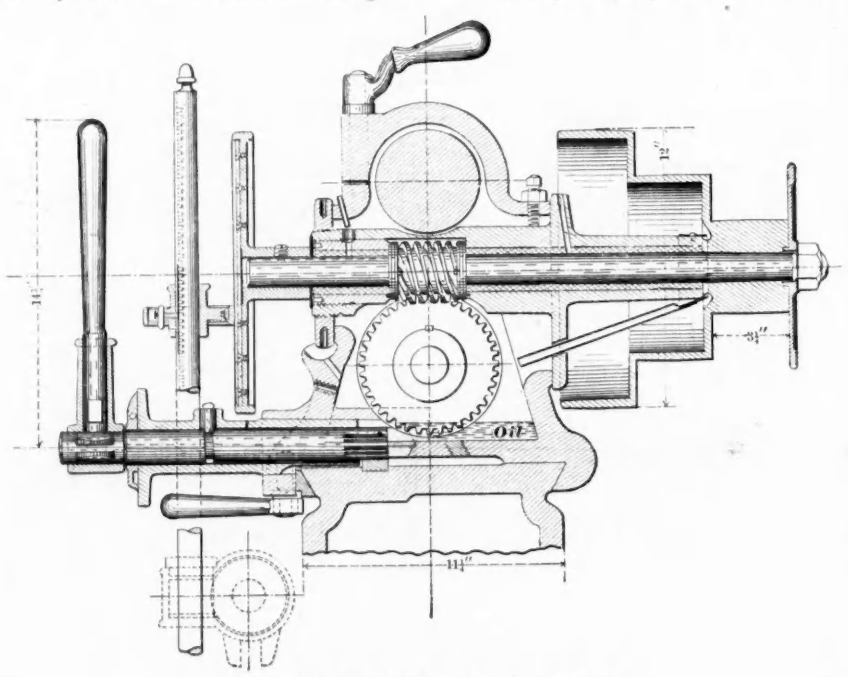
* * * Once in a while you find a man of this class—and generally German by-the-way—who will insist on doing ordinary work by the old plan. Some of his tricks seem ridiculous, but the person who criticizes them will very often find himself disappointed if he goes into comparative tests.

A very short time ago I wanted a rivet about one-eighth of an inch in diameter, and one inch long under the head, of brass. I went hunting around and found a hollow spindle lathe, and put a little chuck on it, and stuck a bar of brass through it, and turned up this rivet, and cut it off; and I know in a general way about how long I was about it. The next day I wanted another one just like it, but did not have time to make it. I gave the sample to an old German workman, and told him what lathe I had used, and where the chuck was, and where the bar of brass was, and all that sort of thing. Then this German said "*Yah*," and he screwed the bar of brass in the vise, dropped a washer around it, and grabbed a big file, and inside of three minutes gave me my rivet. By his crude plan of operation I know he could make fifty rivets in the time I consumed in making the one. Leaving out of consideration the time I consumed in getting ready for this trifling job, I used more time in the actual cutting of the metal than he did.

* * * In machine construction there often occurs a kind of a finished crank, consisting of a flat lever with a hub sticking out one side. The usual method of making these cranks is to bore them out, put them on a mandrel, turn up the hub, and face both sides of the lever. The edges of the lever are then planed, and then the job is put on a mandrel between centers in a shaping machine, and the edge shaped off around the hub, after which it is finished up by filing, &c. The lathe work is all right about this job, buf a good vise hand of the old school will chip and file ten of them while the planer and shaper work is being done on one—and mind you, the work will be just as good too, because in work of this character the planer and shaper merely remove the bulk of the metal and leave a trifle for skilled finishing. The viseman is just as apt to spoil the appearance of the machine-cut job, as he is one he chips from the rough.

* * * Improvements in machinery will always secure their share of admiration, and will always receive fully their share of encouragement, but it is well not to lose sight of the fact that real skill is always required in the shop—I mean the real old manual skill.

* * * Henry Maudsley was one of the old-time famous machinists in England. It may be said in a general way, without any intention of attempting to prove it, that he invented the slide rest, or, in other words, the method of guiding a metal-cutting tool by clamping it in a fixture arranged to have a sliding motion upon a straight guide. This was equivalent to inventing the engine lathe, the planer, the boring mill, the shaping machine, and, we might say, machinists' tools generally—all of which involve, to a greater or less degree, this principle of operation.



MILLING MACHINE DETAILS.—See page 1.

Before Maudsley's time machine tools consisted mostly of lathe and drilling machines. The balance of the work was done by muscle, and by most admirable skill. Men working at the trade then were called engineers, and they are called so yet upon the other side.

After machine tools were invented the tools did the work and the men watched them. Now we call the workman a machinist. The man who stands at the vise and exercises real skill we have no well understood name for, except that of "viseman." Some call them fitters, but they are no more fitters than are the men who work at the tools.

But to return to Maudsley; he went at the carpenter's trade as an apprentice, but he would shirk his duty, and have his pleasure in a blacksmith's shop working in metal. He became very skillful, and also ingenious. Bramah kept a machine shop, such as it was, and Maudsley applied for work there. Not having served his time at the metal trade, things looked rather blue for him. Maudsley noticed a vise-bench which was completely played out all over, and said to the foreman, "If I can put that in any good shape by six o'clock to-night it will probably satisfy you that I am entitled to rank as a tradesman?" He went at it, constructed out of the old bench a new one, which was the best in the shop, welded new steel to the vise-jaws, filled them up, re-cut them, hardened and tempered them, made a new vise out of it, and called the job done.

Not one man out of a hundred working in our shops to-day could do the same thing if you would give him a week to do it in. The man who could do anything with the wooden part of this job could do nothing with the file, or with the blacksmith's part. The blacksmith cannot saw a board off square, or plane the edge true. The blacksmith who could weld the steel jaws on a vise—and there are precious few of them I can tell you—could not cut the teeth in the jaws, and the man who can cut the teeth in them, cannot weld them on, or file them off.

* * * We have little use nowadays for these universal men, but this country is a large one and there are but few large shops in it. The growth is all from small beginnings in the way of employing three or four men, and these men should be of a decidedly useful class.

* * * I mentioned above that Maudsley invented the slide-rest. I will state now that I do not believe a word of it, but I do believe that Maudsley took up the slide rest and detected its latent powers, and schemed out many forms of machine tools involving it, and really pushed it into usefulness. There is precious little satisfaction in raking over history to find out who invented some miserable little thing that was not good for anything after it was invented. So far as the bare scheme of invention is concerned, it is the practical developments of the thing that we ought to recognize to a greater extent than we do. The trouble with popular impression is that in giving due credit to the man who performs the important office of developing an old and useless invention into a public good, it styles the man "the original inventor," and at once provokes discussion and research. There ought to be some word in our language to apply to this class of men, more useful than the real inventors.

* * * While upon the double subject of inventions and of Maudsley and of Bramah incidentally, my thoughts naturally go to the hydrostatic press, which is called the invention of Bramah, and is, in England, generally called the Bramah press. A man's biography generally does him justice, and a little more than justice in the matter of his inventions, and one of the queerest cases that I have ever heard of, is in connection with this same Bramah press and this same Maudsley.

After Maudsley rigged up the vise-bench and vise, and went to work for Bramah, he stood well and became his foreman and his genius. The hydrostatic press had long been known, but it had been a grand fizzle, because no packing had been devised which would prevent leakage around the ram under the extraordinary pressure employed. Bramah took this thing up as a subject of invention and wrestled with it a long time. I quote from his biography by Smiles:

"In his early experiments Bramah tried the expedient of the stuffing-box for the purpose of securing the required water tightness; that is, a coil of hemp on leathern washers was placed in a recess, so as to fit tightly around the moving ram or piston, and it was further held in its place by means of the compressing collar forced hard down by strong screws. The defect of this arrangement was that, even supposing the packing could be made sufficiently tight to resist the passage of the water urged by the tremendous pressure from beneath, such was the grip which the compressed material took of the ram of the press that it could not be got to return down after the water pressure had been removed. In this dilemma Bramah's ever ready workman, Henry Maudsley, came to his rescue. The happy idea occurred to him of employing the pressure of the water itself to give the requisite water-tightness to the collar. It was a flash of common-sense genius, beautiful through its very simplicity. The result

was Maudsley's self-tightening collar, the action of which a few words of description will render easily intelligible. A collar of sound leather, the convex side upwards, was fitted into the recess turned out in the neck of the press cylinder at the place formerly used as stuffing-box. Immediately on the high-pressure water being turned on, it forced its way into the leathern concavity, and flapped out the bent edges of the collar, and in doing so caused the leather to apply itself to the surface of the rising ram with a degree of closeness and tightness so as to seal up the joints the closer, exactly in proportion to the pressure of the water in its tendency to escape. On the other hand, the moment the pressure was left off, and the ram desired to return, the collar collapsed, and the ram slid gently down perfectly free and yet perfectly water-tight. Thus the former tendency of the water to escape by the side of the piston was, by this simple and elegant self-adjusting contrivance made instrumental to the perfectly efficient action of the machine, and from the moment of its invention the hydrostatic press took its place as one of the grandest agents for exercising power in the concentrated and tranquil form."

"Bramah continued his useful labors as an inventor for many years. His study of the principles of hydraulics in the course of his invention of the press enabled him to introduce many valuable improvements in pumping machinery."

The sentence "Bramah continued his useful labors, &c.," reads very queerly following on the above. This quotation is from the biography of Bramah and not from that of Maudsley. It relates to the Bramah press, and not to the press of Maudsley. Nobody ever heard of a Maudsley hydrostatic press, and nobody ever heard of Bramah doing much to it except to make it useful.

Very respectfully, CHORDAL.

The Milling Machine—Its Construction and Uses.

SEVENTH PAPER.

By JOHN J. GRANT.

Milling bevels or square locks for gibbed slides in a common slab milling machine without a special fixture is a difficult operation and one requiring great care, and should only be placed in the hands of a good workman. But in case a number of pieces are to be milled, as in machine tool construction and other similar work, a fixture can be made like the drawing, Fig. 1, that will make the operation as simple as plain milling, and very accurate work can be done by it. The fixture shown, if made to the given dimensions, will be suitable for use with the Lincoln pattern milling machine and is of the same size as the one mentioned in my last. The base, *A*, is made in the form of an angle iron, with a good heavy bottom, and if made for general work, and not for a special purpose, it should be of the same length as the full traverse of the milling machine platen and be fitted with a sliding, or more properly speaking, an elevating slide made to raise with a screw and hand wheel. See plan, Fig. 2. On the bottom of the elevating slide a narrow projection is cast running the entire length, and about one and one-half inches wide.

T slots should be milled through for $\frac{1}{2}''$ bolts. Three or four of these slots will not come amiss. When the fixture is fastened to the platen, the best plan is to use a face cutter and mill off the faces marked in dotted lines, Fig. 1, *A*. This will insure a perfect surface, also bring it to perfect right angles with the spindle or cutter arbor. A threaded stop *G* is arranged to adjust the elevating slide for the width of the space to be milled out. This stop must be very rigid to insure perfect uniformity of sizes in the pieces being milled. In a fixture where the slide is very long and cannot be made of sufficient height to have the perpendicular slide long enough to make it rigid, two stops should be used, one at each end, screwed fast to the bottom or base of the fixture and having nuts at the top and bottom to adjust.

In case the fixture does not mill parallel, the nuts can be adjusted so that the elevating slide can be forced either up or down against them. The fixture would probably be made so that the variation would be only slight, but if the difference were but $\frac{1}{1000}$ of an inch in a piece 6″ or 8″ long the extra fitting would be considerable.

For work requiring taper gibs, as in some tool slides for lathe carriage or planer cross-heads, the elevating slide can have an extra piece fitted to it, with the projection cast on it instead of on the slide itself. This piece should swivel in the center with circular slots in each end and be graduated on one end in the same manner as the taper bar of a Slate's taper turning attachment, to inches and fractions of an inch per foot. A stop at one end of this is sufficient.

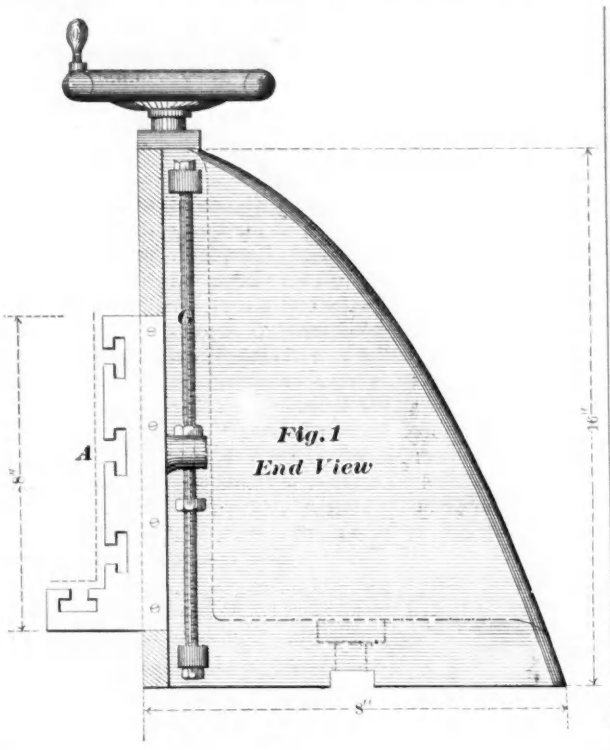


Fig. 1
End View

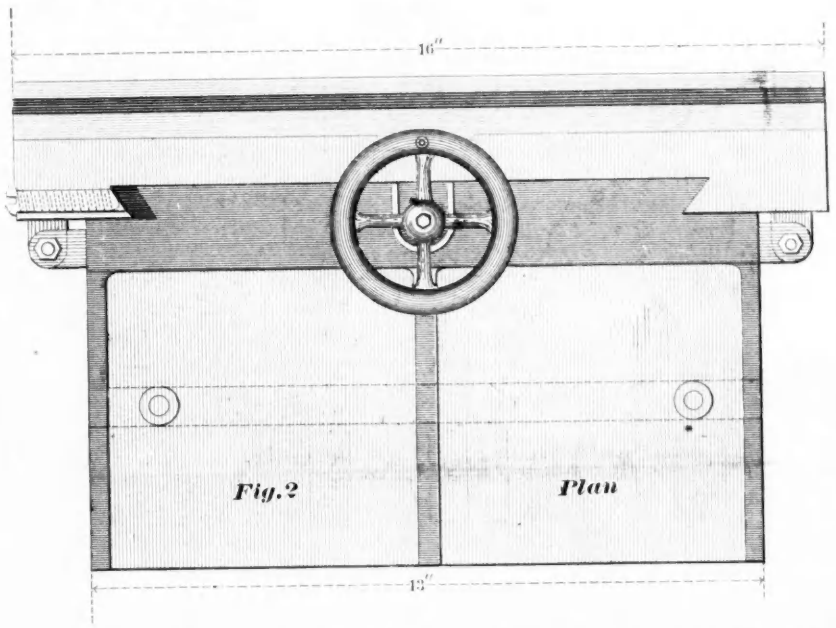


Fig. 2 *Plan*

If the machine used is of the pattern called base or column miller, where the knee or elevating slide adjusts for the cut instead of the spindle, then the elevating slide on the fixture can be dispensed with and the attachments placed directly on the knee or angle piece of the fixture itself. This arrangement will be found not alone handy for milling bevels or square locks for slides, but can be used for an almost endless variety of jobs, such as cornering work with a small shank cutter, milling *T* slots, and quite a number of operations in die sinking, as well as other work.

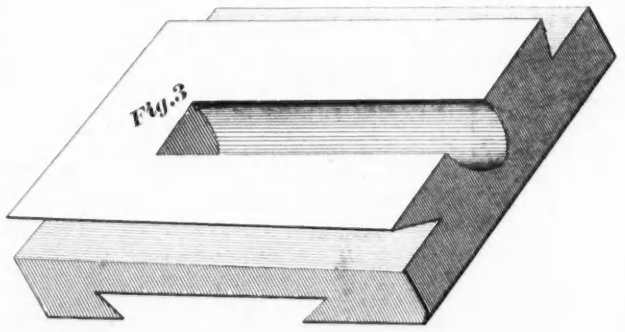


Fig. 3

A bevel piece can be screwed to the slide and if hung in the center and made so that it will adjust to horizontal or perpendicular, work can be milled that has a bevel on both sides, such as the intermediate slides of a lathe slide rest, which has the bevel slides at right angles to each other. See the drawing, Fig. 3. Work can of course be done without these little attachments, but a short time spent in making a few simple handy devices will very often repay their cost in the first lot of machines built. A little calculation will determine whether there is a sufficient quantity of the work to be done to pay for the necessary fixtures and tools. If care is used in designing the cutters to be used with this fixture and the shanks are made to interchange, the square with the bevel and *vice versa*, a few cutters will accomplish a great many different sizes and kinds of work. As a general thing, no work can be done on this fixture with anything except shank and face mills. The small sizes of cutters may be screwed on the shank, as in the drawing of the finishing cutter shown in my last number. The larger sizes should be fitted to the shank, splined and fastened to it by means of a large headed screw that is tapped into the end. See drawing, Fig. 4. Only in special cases can a cutter be used that is fastened to the arbor with a nut at its outer end.

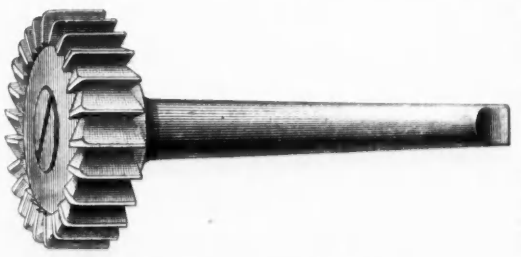


FIG. 4.—CUTTER, ONE-THIRD SIZE.

In cutters to mill a bevel, care must be taken to have the side that comes next to the shank or arbor ground perfectly true with the hole, as a slight variation will throw the cutter out of truth and destroy the angle. This true face will also be of great benefit when grinding the angle or bevel, which should be done very accurately, and cannot be done with any satisfaction without a good cutter grinder with a graduated fixture. Always remember that a few minutes spent in making or keeping tools in order will save hours of the fitter's time, which is worth three times the services of the milling machine operator.

Central of New Jersey Railroad Locomotive 169.

Engine 169 of the Central of New Jersey Railroad, which was illustrated in the AMERICAN MACHINIST April 1st, 1882, is in the shops at Elizabethport for heavy repairs. The left-hand cylinder is broken at the saddle, and it has been determined to give the engine a pair of new cylinders. One of the driving axle-boxes was broken in two pieces, and all the others were in bad order. There has been a good deal of trouble experienced with the driving boxes of this engine, the oscillation of the large driving wheels having a tendency to break off the driving-box flanges. We observed that the outside sheets of the fire-box were badly rubbed by the lateral motion of the wheels.

Mr. Woodcock, the master mechanic of the Central of New Jersey Railroad, is going to put back the Allen valves on engine 169, as he thinks they have done excellent service. When the Allen valves were first put in, they wore the seats so badly that they required facing every two months. The Richardson balancing device was put on the valves and the engine ran thirteen months without facing, and they were in good order when 169 went into the shop for repairs. All the fast passenger engines owned by this road now have the Allen valve and Richardson balance.

The Manhattan Elevated Railway Company have commenced to build a new locomotive in their shops, at 98th street, New York. The engine is of the Forney type, and embraces a great many improvements suggested by practice in operating the road. Should this engine prove as successful as the officers of the company expect, a number of new locomotives will be ordered after its pattern.

One day recently, the foreman of the blacksmith shop connected with a locomotive building establishment was absent for an afternoon. While he was away a misunderstanding arose between two of the helpers, and they proceeded to settle the matter after the methods of Mace, Sullivan and Company. A ring was formed, and all the work in a shop, containing over one hundred men, was stopped so that all hands could witness the free combat. We cannot give our readers the details of the fight, but we are reliably informed that it lasted ten minutes, and that not a stroke of work was done till the dispute was settled.

The rapid growth and enormous possibilities of Western Texas are well illustrated by the statement that Abilene, 160 miles west of Fort Worth on the Rio Grande division of the Texas and Pacific Railroad, a prosperous and enterprising town, which three years ago had no existence, now contains a population of 4,000. Colorado City, on the same line of railroad, 230 miles west of Fort Worth, has grown from nothing to a population of 6,000 within the same short space of time. Texas organized sixty-eight new counties last year, making 200 in the State. The increase of her taxable property in the year was $130,000,000. Machine shop proprietors who want to grow up with the country might perhaps find some of these Texan towns worth visiting, with an eye to business. The rapid growth of towns and cities, coupled with the fact that manufacturing enterprises are generally welcomed and aided, should help in establishing a business in a small way, which with the increase in population and wealth would correspondingly increase in its proportions.

Intricate Core Work.

BY WALTER L. CHENEY.

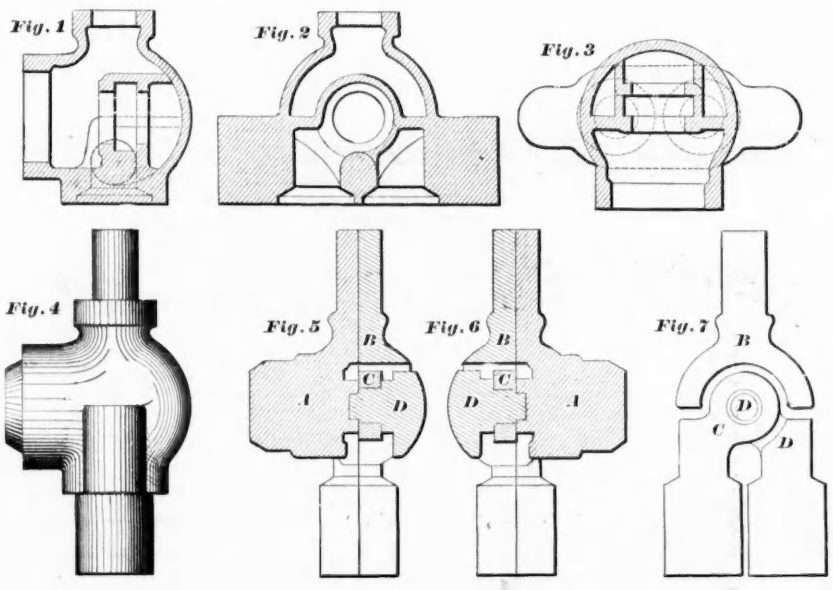
The fineness of the casting, and more especially the perfection of the coring of the Hancock Inspirator, has excited the admiration of every one who has had an opportunity of examining it. "The finest I ever saw," has been the verdict of numerous mechanical engineers that the writer has had the pleasure of showing through the factory, and it is this voluntary expresssion of their opinion that has prompted the attempt to show the nature of the work, and the means used to accomplish it.

The subject selected for illustration is the "cap" of the smallest locomotive inspirator, which is shown in three sections, Figs. 1, 2 and 3—Figs. 1 and 2 being elevations, and Fig. 3 a plan. A little study of these sections in connection with Fig. 4, which represents the pattern, will give a fair idea of the general shape, both inside and out, and will also probably convince the reader that things cannot always be judged from outside appearances. It is quite amusing to see a person, after having examined the shape of one of these caps, *try to look through the hole!*

Figs. 5, 6 and 7 are intended to represent the core, which is composed—as will be seen by reference to the figures—of six pieces, which are by means of a special appliance shown in Figs. 8 and 9 correctly assembled and pasted together.

Fig. 5 represents that part of the core which forms the shape shown in Fig. 1, and Fig. 6 is the other half of the same. Fig. 7 shows the part of the core which belongs with Fig. 2. This is not in section, as it will be seen by reference to Figs. 5 and 6 that the face comes directly on the center parting of the core-box, and is therefore not supposed to be cut. Similar parts in Figs. 5, 6 and 7 are marked with similar letters, and a better idea of the make up of this core can be had by following these parts from one view to another, than by reading any description that I could give. It will be seen that each part of the core is attached to the other in such a manner, that the whole must be concentric and absolutely correct.

Figs. 8 and 9 are an elevation and plan of the complete core, resting in the special appliance referred to above, which consists of a light cast-iron frame. The parts on which the core rests are accurately spaced and finished so that the core lies in this frame exactly as in the mould. The core is pasted together in this frame and remains there till dried, thus making it absolutely certain that every part of the core is exactly right when finished.



The Railway Cab Electric Signal Company, New York, have got their signaling apparatus in operation on some parts of the Elevated Railroad. It is an electric block system. An electrical apparatus, operated by a small dynamo on each locomotive, closes the block till the train has passed out. The signaling is done by bells or whistles, these being automatically sounded should an engine enter a block before the preceding train has left it. By means of boxes along the line a block can be closed, if it becomes necessary to stop a train for any purpose. The means of electric transmission used is wires passing alongside the track, and connected to insulated rails at the signaling points.

An instructive accident happened to the Ball engine at the commencement of the Boston fair. Some time previously a cast-iron fitting on a steam pipe was accidentally broken and replaced by a new one. It seems pains were not taken to remove all the broken pieces from the pipe, and after a time one of them found its way along the pipe and into the steam chest of the engine, the result being a broken rock-arm. The piece was removed, a new rock-arm put in place and the engine again started. After some time the engineer, warned by a suspicious noise, again stopped, and this time a piece was found that would in all probability have worked into a position in the cylinder where it would have made a wreck of the engine. The pipe was somewhat faithfully explored before starting again.

The Outcome of the Gaffney Boiler Explosion.

Our readers will remember a disastrous boiler explosion that occurred at the works of Gaffney & Co., Philadelphia, in June, 1881. The boiler that exploded had been inspected and insured by the Hartford Steam Boiler Inspection and Insurance Company. A coroner's jury found a verdict censuring the Hartford Company, but this verdict was somewhat sharply criticized at the time as not being sustained by the facts in the case.

In the AMERICAN MACHINIST of July 23d, 1881, we published an article contributed by F. B. Allen, accompanied by engravings made from photographs of parts of the boiler. In this article the writer stated very clearly what seemed to be the cause of the explosion, which was gross carelessness and incompetency; something over which the insurance company had no control. An action, however, was commenced against the company for damages for the loss of the life of a child. This suit has just been decided in the United States District Court in a way entirely exonerating the Hartford Company, and sustaining the views of our contributor.

Smoke Consuming on the New York Central Railroad.

All the passenger and quite a number of the freight locomotives on the New York Central Railroad have the Buchanan fire-box, which is making an excellent record as a means of preventing smoke and for doing work with a light expenditure of coal. That fire-box has a water table which crosses diagonally from under the bottom row of tubes to the back sheet over the fire-box door. All the gases of combustion have to pass to the tubes through an opening in this water table. In practice it is found that this gives the means of thoroughly combining the volatile gases from the coal with currents of air admitted to complete the combustion.

Owing to the first cost of getting out the necessary plant for keeping an accurate coal record, this road has not adopted the premium system for engineers and firemen, but Mr. Buchanan is striving to impress upon the men the necessity for improved methods of fire management. In the cabs of all the locomotives "instructions for firing and to prevent engines smoking" are posted. Therein the fireman is directed to "keep coal wet as much as possible. When a shovel of coal is thrown into the fire-box keep door open partially until smoke is consumed. Regulate the closing of the door by watching stack. If black smoke escapes it is a sure indication that the door is closed too soon after firing, and when running into or standing at station turn on the steam blower a little and open the furnace door to admit air so as to consume the smoke, and also avoid firing when passing through cities, towns and villages." If a fireman obeys these instructions and carries as light a fire as possible, never putting more than two or three shovelfuls of fresh coal in at one firing, the work will be done economically, and bituminous coal can be burned without causing a smoke nuisance.

We understand that this road has decided to adopt the Richardson balance valve, and that a contract has been made for putting ten on each month till the equipment is complete.

While a representative of the AMERICAN MACHINIST was looking round a boiler-making establishment the other day, a wagon drove in, loaded with a venerable upright boiler, which had been replaced with a new one. An inspection showed that the worn-out boiler was badly corroded round the bottom seam, and the AMERICAN MACHINIST man ventured the opinion that it was not replaced any too soon. The head of the establishment answered that it was in good order compared to many boilers that they had handled. Just a few weeks ago they went to move an upright boiler, and when they hoisted it up the leg fell out. Yet that boiler had been doing work on the previous day.

Shop Notes.

In the new shops of the Putnam Tool Company (S. W. Putnam's Sons), at Fitchburg, Mass., an idea is carried out in regard to small tools somewhat different from the general machine shop practice in that respect. An entire set of such tools is provided for each size of machine built, without reference to the fact that many tools already made could be used. Let the machine be, for instance, a 20″ engine lathe. All the small tools required in its construction, such as reamers, taps, cutters, counterbores, &c., including the necessary gauges, are made and kept in a tool-box provided for the purpose and suitably marked. Now suppose designs are made for a 24″ lathe. Almost, as a matter of course, some of the tools already made for the 20″ lathe would be suitable for use on the new design, but instead of using them, an entire new set is made and kept as in the other instance in a special tool-box. And so on as each different size of any class of machines is brought out. An argument against this system would be that some tools will be duplicated and reduplicated at considerable expense. Thus, if there were a dozen different machines made it would not be beyond reason to suppose that somewhere on the work of each an inch reamer would be required. Instead of one one-inch reamer for all, it will be seen that this system will require twelve one-inch reamers, each to be used for no other purpose than in connection with the work on the machine to whose set of tools it belongs. Upon this feature and upon strictly carrying it into practice, the value of the system depends.

As against the hypothetical argument referred to, is the one that practically the preservation of sizes and forms in ordinary machine work depends upon the fact that finishing tools if properly made and cared for, will maintain their size and form through considerable use, the time depending of course upon how much they are used. Thus, while theoretically a fluted reamer may not ream two holes in two pieces of cast iron of the same diameter, it will ream them near enough of a size for all ordinary purposes, and so with the work done with taps and other cutting tools. And they will continue to do this for a long time if not in general and too constant use. By this system, taking as an example the one-inch reamer, the work that might be done in a given time by one tool is divided between twelve, so neither is excessively used. In this way the tools used, in addition to their primary functions, become gauges for maintaining standard sizes and shapes, and for the duplication of parts, which would not be the case if they were used commonly and indiscriminately. It is not necessary that tools, of different sets, nominally of the same dimensions, should be so actually, since any variation in this respect can cause no confusion.

Another feature incident to this system is that it removes the temptation to use a tool not just right as to size, or some other feature, to save the trouble and expense of making a new one; in other words, making the work to the tool, instead of the tool for the work.

In the shops referred to, the work of designing a new machine is entered upon systematically. The most desirable dimensions, ratio of gearing, &c., are first carefully determined, and a sheet is filled out with these data. Then in making the drawings this is rigidly adhered to, the incidental parts of the machine being made to conform to the essential parts without compromising with regard to the latter. This sheet, properly filed, is convenient for future reference, as it presents the salient features of the machine at a glance, saving time in overlooking drawings or reading long specifications.

In the new designs of tools already brough out it is evident that the propriety of providing for coarse feed has received due consideration. The face plate (full size) of a new 16″ lathe was noticed, and a rule laid on showed the feed with which it had been faced up to have been $\frac{3}{8}$″. We were informed that the actual time of taking the finishing cut over the face of the plate was two and one-quarter minutes. Most lathemen have had occasion to grumble at some time at not being able to get sufficiently coarse cross feed, but this feed on a lathe of that size, would probably satisfy them.

One point noticed in the lathe construction in these shops is making the front V for the carriage at an angle about 10° more obtuse than the back one. When it is considered that the average pressure with the lathe at work is materially greater on the front V, this looks to be a point well taken. Another point is the studied construction of the carriage work to prevent the lodgement of chips and dirt where it can do damage. Rounded corners, from which the dirt will fall off, instead of sharp corners, upon which it will lodge, are the rule.

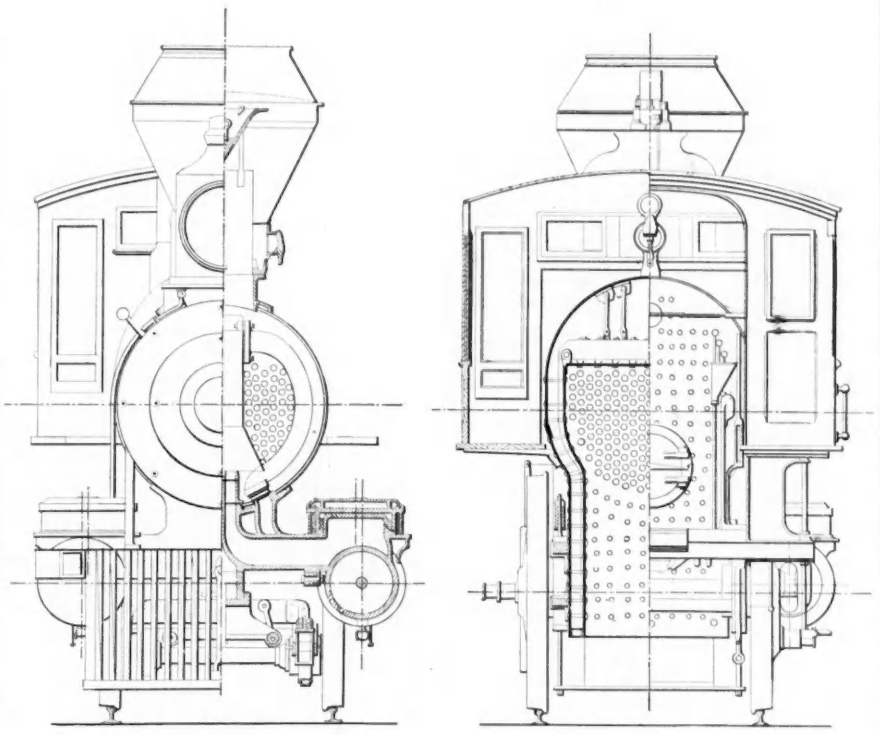
On the steamship Werra, belonging to the North German Lloyd line, we observed a convenient rig, which we are surprised is not more extensively used on large steamers. Below the skylights of the engine-room and

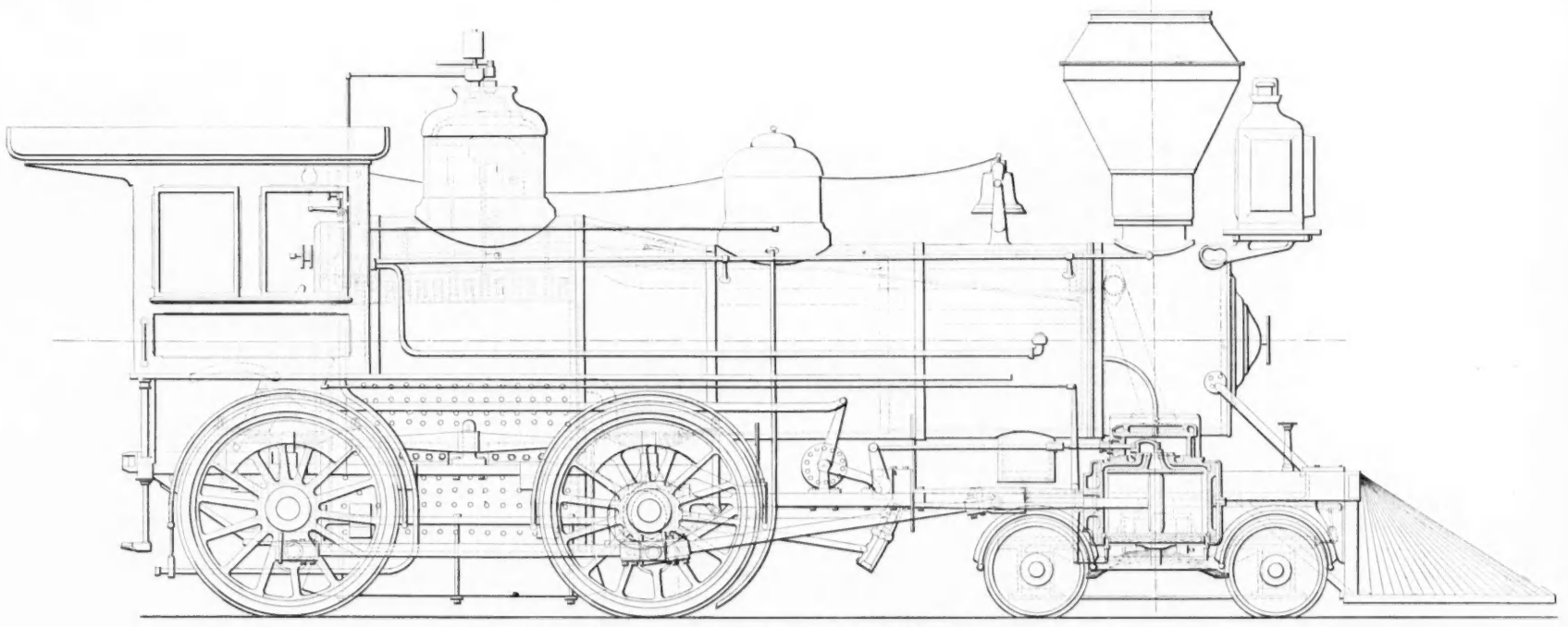
above the cylinder heads, a traveling crane is fitted up which traverses the whole space. Attachments are ready to connect with the cylinder heads or steam-chest covers and they can be hoisted off in a few minutes. The crane can also be used for handling any other part of the engine that has to be moved.

Standard Locomotive Northern Pacific Railroad.

The three engravings on this page represent class *C* 2, the standard locomotive of the Northern Pacific Railroad. These engines were designed by G. W. Cushing, superintendent of rolling stock and machinery of the Northern Pacific Railroad, and were built by the Baldwin Locomotive Works, Philadelphia. The engines were designed specially to handle the heavy main line work, and they are equally suitable for passenger or freight service. They are admirably adapted for ordinary passenger and fast freight trains, their construction enabling them to combine moderate speed with great power.

The total weight of this locomotive in working order is 83,800 pounds, of which 54,350 pounds rest upon the drivers. The cylinders are 17x24, which apply power to driving wheels 62″ diameter outside of tires. The distinguishing feature about the engine is the boiler, which provides no less than 1,335 square feet of heating surface. In locomotive practice there always has been a tendency to make the cylinders beyond the steaming capacity of the boiler. This entails destruction to sheets and tubes by continual forcing of the fire to keep up steam, a process





STANDARD LOCOMOTIVE OF THE NORTHERN PACIFIC RAILROAD.

that proves disastrous to the coal pile. The spacious heating surface ought to enable these engines to do their work easily and economically. There is 16 square feet of grate area, and the fire-box provides 117 square feet of heating surface.

The leading dimensions are:

Distance between center of front and back drivers	8′ 6″
Distance from center of main drivers to center of cylinders	11′ 11¼″
Length of main rod	8′ 1⅞″
Distance between centers of cylinders	6′ 2″
Thickness of piston and follower	0 4¾″
Diameter of piston-rod	3″
Size of steam ports	16″x1⅝″
Size of exhaust ports	16″x2½″
Greatest travel of slide-valve	5½″
Outside lap " "	1 3/16″
Inside " "	1/16″
Lead in full gear	3/32″
Sectional area of steam-pipe opening	15.9″ sq.
Size of driving-axle journals	7½″x8½″
Size of main crank pins	4¼″x4¼″
Side-rod pins	3½″x3½″
Inside diameter of smallest boiler ring	4′ 3″
Thickness of boiler plates	½″
Number of tubes	196
Length of tubes	11′ 11½″

Locomotive Engine Running.

BY ANGUS SINCLAIR.

CARE OF LOCOMOTIVE RODS.

When it is found that an engineer runs his engine for months on arduous train service and has no trouble with his rods, he may safely be credited with knowing his business and attending to it skillfully. In regard to the keeping of the machinery in working order, the engineer's duties are mostly of a supervisory nature. When piston rings get blowing, when guides need closing, or when a pump gets working badly, he reports the matter and the work is done so that the defect is remedied. With the rods it is different. Although he does not file the brasses himself, he exerts great influence for good or evil in the way he manipulates the keys and by the care he takes of the rods. Injudicious keying of rods is responsible for more accidents than the mistakes in any other one direction, with perhaps the exception of the current mistake of the hind brakeman, who supposes there is no use in going back to flag when his train has stopped between stations.

FUNCTIONS OF RODS.

The functions of rods being to transmit the motion of the pistons to the running gear, they have very heavy duty to perform. The conflicting strains and shocks to which a locomotive is subjected while running over a rough track at high speed are in many instances sustained by the rods, hence it is of special importance that this portion of the motion should be kept in good order. Main rods convey the power developed in the cylinders to the crank pins by a succession of pulls and thrusts equal in vigor to the aggregate of steam pressure exerted on the piston. To endure this alternating tension and compression without injury to the working parts, it is of the utmost importance that the connections should be close fitted, yet free enough to prevent unnecessary friction. In fitting up main rod brasses, it does not matter in what position the crank stands so long as it is convenient for doing the work. But if the engine has been in service since the pins were turned, they should be calipered through their horizontal diameter when the crank is on the center, since it is well known that the pins have a tendency to wear flat on the sides at right angles to the crank's length. The back ends of the main rod brasses should be fitted brass to brass, for that form of doing the work makes the most secure job, and gives the connection all the advantages of a solid box, preventing the straps and brasses from being knocked out of shape by hammering each other, a result that surely follows the open brasses method of fitting back ends of main rods. Leaving the forward end brasses a little open is not injurious to that connection, because the line of strain is not so varied as that of the back end.

EFFECTS OF BAD FITTING.

When the work of fitting a set of back-end brasses is completed, they should be put in the strap and tried on the pin. If, after being keyed close together, they revolve on the pin without pinching, the fit is not too tight. It is of the greatest consequence in fitting rod brasses to ascertain beyond doubt that the brasses have been bored out true, and that they fit in the strap so that the line of strain shall be in line with the cross-head and crank pins. It occasionally happens through bad workmanship that when the back end of a rod is keyed up, and the front end not connected, that the rod does not point straight to the cross-head pin, but in a line some distance to the right or left. The distance may be very small, yet sufficient to cause no small amount of trouble. By some pinching and jamming, a rod in this condition can be connected up, but it is almost sure to run hot. And a rod in this condition will never run satisfactorily till it is taken down and fitted by a competent machinist. The back end may be all right, and the forward end suffering from oblique fitting. This is even more common than the first case, and the effect is the same. A rod in this condition, besides displaying a tendency to run hot, will keep jerking the cross-head from side to side on the guides, and will probably make the cross-head chafe the guides at certain points. Rods never run cool and free from jar unless they are fitted to transmit the power in a direct line between the pins.

STRIKING POINTS AND CLEARANCE.

Before putting up main rods the striking points of the pistons should be located and marked on the guides. Then, when the rods are put up, the clearance should be divided equally between the two ends. The identification of these points is of greater interest to the engineer who is running the engine than to any other person, for upon their correctness the success of his running may to some extent depend. An engine may go out with the clearance badly divided and run all right for a few days, and the driving of a key may then cause the piston to strike the head. A striking instance of this kind once came under my observation. A careless machinist, in working on main-rod brasses, had mixed the liners and shortened the rod till the piston began to touch the back-head. When the engine was working light there was just a slight jar, but when the load was heavy the jar became a distinct pound. The engineer could not locate the knock, and was disposed to think it was in the driving-box. One day that he slipped the engine badly, steam began to issue from the back cylinder-head, which was cracked by a blow from the piston. The cause of the pound was then discovered.

WATCHING RODS ON THE ROAD.

When an engineer starts out with an engine after the rod brasses have been filed, he should make them a special object of attention. If he cannot shake the connection laterally with his hands when there is room for movement within the collars, he should slack up the key till he can do so, for some one has made a mistake in fitting. So long as the rod passes the center without jar when the engine is working hard in full gear, the brasses are tight enough. After running a few miles with newly fitted brasses, the rod will generally need keying up, for liners that were comparatively loose when put up get driven

compactly together leaving lost motion. Although a connection may be put together brass to brass, there is still some work left for the engineer to do in the way of keying. To do keying correctly needs considerable sagacity, especially in the case of side rods. In the case of back ends of main rods the key should be got down as soon as possible to hold the brasses immovably in the strap, but after this point is reached there should be no more hammering on the key. Some men persist in pounding down keys that are already snug, and the effect of their blows is to spring the brass out of shape. A key acts as a wedge, which it is, and when the taper is slight the blow imparted by a hammer roughly used, exerts an immense force in driving it down. Something must yield, and the brass gets sprung towards the pin presenting a ridge for a rubbing surface which heats and causes delay. After the key is once driven tight home, its work is finished. If the pin then indicates lost motion, the rod should be taken down and the brasses reduced. In the case of main rods this should be done at the first signs of pounding, for lost motion entails heavy shocks upon the moving parts. The front end of main rods requires to be very carefully watched and the connection kept free from jar. Where this part is kept regularly oiled and free from lost motion it gives scarcely any trouble, but let the wrist pin of the common cross-head once get cut through neglect, and it is a difficult matter getting it in good running order again. The style of cross-head where the pin is part of the casting, although greatly used, is a most awkward article to fit up and keep in shape. The form of cross-head which works between two guide bars and has its axis in line with the piston rod, is becoming deservedly popular.

SIDE RODS.

Many attempts have been made to dispense with side rods, and they certainly are a troublesome part of the machinery to keep right, but no better means of connecting driving wheels has yet been devised. The first method of coupling driving wheels together so that more than one pair might be available for adhesion was by means of cogs and gearing. This was improved on by an endless chain working over pocketed pulleys, but even this was an extremely crude device, working with tumultuous jerks and a noise like a stamping mill. One of the first real improvements which George Stephenson effected on the locomotive was the inventing of side rods. An essential element in locomotive construction needed to make side rods run with safety, is that all the wheels connected shall be of the same circumference. There is a practice on some roads of putting new tires on wheels just as they come from the rolling mill without putting them in the lathe. Such tires are seldom accurate in size, and they cause no end of trouble, especially to side rods. This is one of the economical practices that does not pay.

ADJUSTMENT OF SIDE RODS.

To connect driving wheels so that they will run together in perfect harmony, after ascertaining that they are the same size, the next point is to secure the crank pins at an equal distance from the centers of the wheels. When this is done, and the wheels trammed parallel to the line of motion, the rods will move on a plane with the centers of the crank pins exactly the same distance apart as are the centers of the driving axles. The rods can be adjusted to the greatest advantage with the steam raised, so that the heat of the boiler will make the frames about the same length as when the engine is at work. The expansion due to the heat of the boiler is short when measured by a foot-rule, but it affects the smooth action of the side rods to a remarkable extent.

Before tramming for the side rods it is necessary to have the driving-box wedges set up just tight enough to let the driving-boxes move vertically in the jaws without sticking. The distance between the centers of the driving axles and the centers of the crank pins having now been found equal, the rods are fitted up, each connection being secured a close fit to the pin, with the brasses held brass to brass. With the brasses bored out exactly to the size of the crank pins and the rods accurately fitted, a connection could be made which would bind the two sets of drivers to move as an unbroken unit, were it not for the disturbing element which appears in the shape of rough track. With uneven track and worn wheel tires, a tremendous tension is put on the rods where the connections are closely fitted. Provision is made for this source of danger by leaving the brasses of the back pins loosely fitted. A yielding space is left between the brass and the pin, not between the brass and the key or strap. The latter connections must be perfectly snug or the strap will soon be pounded out of shape.

In the case of ten-wheel and consolidation engines, the brasses of all wheels behind the leading pair should be bored out $\frac{1}{64}$ larger than the pins, which will generally be sufficient. In case a pin is sprung, which is no rare circumstance, room enough must be left in the brass to let the pin pass over its tightest point without pinching. The center is the proper position to put up side rods on.

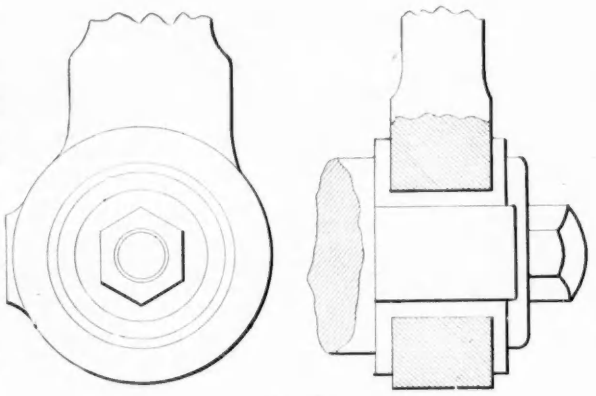


FIG. 1.

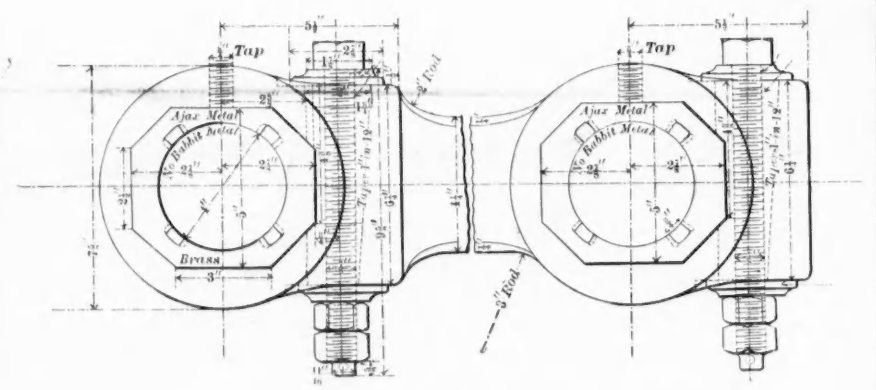


FIG. 2.

Some men like to fit side rods with the cranks on the eighths position, holding that there the greatest strain comes on, and consequently that there fitting up should be done. That is a mistaken idea, for rods may be put together on the eighths and yet bind the pins badly in passing the centers. On the other hand, if they pass the centers easily, they will go round the remainder of the circle without danger.

KEYING SIDE RODS.

When it is necessary for an engineer to key up side rods, he should select a place where the track is straight and as even as possible. Then he should put the cranks on the center and take care that he can move the connections tolerably after the job is done. If he now moves the engine so that the cranks are on the other center, and finds that the rod connections can still be moved, that side is all right. If the other side be treated in a similar manner, his rods are not likely to give trouble. With a worn-out engine and rough, road-bed, it is a difficult matter to preserve the true mean between loose and tight side-rod connections. But in a case of doubt the loose side is the safe side. Yet most engineers are inclined to err on the side of danger, for they will generally tighten up the rods to prevent them from rattling. On a Western road where solid ended brasses were adopted, it was often amusing to hear the engineers protesting against the noise the side rods made when the brasses began to get worn. They would rattle from one end of the division to the other, but they would not break pins or fracture themselves and tear the cab to pieces or ditch a train, as happens so often from other rods being keyed to prevent noise. Sprung crank pins and broken side rods are very often the result of injudicious keying.

SOLID ENDED SIDE RODS.

A great many railroads are adopting solid-ended side rods, and where they have been fairly tried they give more satisfactory results than strap-ended rods. Figure 1 represents the end of a rod that is becoming common in the East. The C. R. I. and P. Railroad has also adopted this rod. The section of the rod differs on different railroads. Some master mechanics prefer an oblong solid section, while the greater part prefer a double channel section. The latter is considered the strongest for the amount of material used. With the rod shown in Figure 1 a plain brass bush is used, which is forced into the rod by pressure. When it gets worn, the bush is removed and a new one put in. Figure 2 shows the kind of end in use on the P. and R. Railroad. The brass in this rod is octagonal, in two parts, and can be closed up when it becomes worn by turning down the bolt. A good point about this brass is that there is no danger of its turning round in the rod and closing up the oil holes, as the plain brass bush sometimes does.

The trustees of the New York and Brooklyn Bridge have taken one step towards making the bridge free to the public. They have voted continuous free passes to themselves and their families.

The American Institute Fair, now running in this city, attracts the usual crowds of visitors. While most of the exhibits are such as may be seen by walking along our principal streets, there is enough of novelty to interest almost any visitor. Steam engines predominate in the machinery department.

The most interest seems to center upon a Straight-Line engine of 38 horse-power, which is noiselessly making 245 revolutions a minute.

It is not bolted to the bed, yet vibrates scarcely any at all. E. W. Bliss, of Brooklyn, shows, besides a line of presses for sheet metal, several Waldron rotary engines. Since this engine was illustrated in the AMERICAN MACHINIST of July 30, 1881, it has been provided with a cut-off. One is to be running before the fair closes. Two sizes of a new gas engine are shown by the Continental Gas Engine Company, 231 Broadway, New York—one of a horse-power and the other of half a horse-power. They appear to run well. The Pictet ice machine is at work making blocks of ice. Detrick's single post iron planer, illustrated in the AMERICAN MACHINIST of October 14, 1882, is running, and attracts considerable attention from mechanics.

E. E. Garvin & Co., of New York, have the principal display of machine tools. They show a variety of improved milling machines, spindles, drills and foot lathes. In some of the spaces machines are yet to be placed.

Engines of the Steamship Oregon.

The Guion Line's new steamship Oregon made a very successful maiden voyage across the Atlantic. This vessel was built specially for speed, and the first trip indicates that the intention of the owners to make her the fastest passenger boat afloat is not likely to meet with disappointment. The voyage was made in little over seven days, although the engines had to be slowed down several times on account of hot bearings. In addition to that source of delay, a steam joint between the high pressure and one of the low pressure cylinders blew out and had to be patched up with a clamp joint. There was also some trouble experienced with stuffing-box packing blowing out.

The hull of the Oregon is of steel, and that material has been largely employed in the minor fittings. The vessel is splendidly equipped in every particular, but the powerful engines are the distinguishing feature. They are of the compound vertical inverted type, three cylinders being used, standing in line above the main shaft. The middle cylinder receives the steam direct from the boilers, and exhausts into the casings from whence the steam is taken into the low pressure cylinders. The high pressure cylinder is 70″ diameter and the low pressure cylinders 104″ diameter, all having a stroke of 72″. Piston valves are used to distribute the steam to all the cylinders. The high pressure cylinder has one valve, and the low pressure cylinders have two valves each. Cast-iron packing rings are used on these valves, and are carried by a heavy bull ring that fits on the spider. A built up crucible steel crank shaft is used, and all the cranks are counterbalanced. The tunnel and propeller shafts are also of crucible steel, and the thrust consists of twelve adjustable bearing rings. The surface condenser, which is placed behind the line of cylinders, is divided into two separate parts, one for each of the low pressure cylinders. Water to the condensers is supplied by two Gwynne rotary pumps No. 13, driven by independent engines. Reversing the engines is done by means of a combined hydraulic and steam engine specially devised for that work. Independent steam pumps are used for emptying the bilges, and the ashes are hoisted on deck by Brotherhood engines. A traveling crane traverses the upper part of the engine-room, and strong screws are attached which pull up any of the heavy weights that have to be lifted.

Steam is generated by nine steel double-ended boilers with four Fox's corrugated furnaces at each end. They are arranged athwart-ship, three in a line.

To operate the power department of this boat, ten engineers and one hundred and ten firemen are employed. The chief engineer keeps no watch, of course. The second, third and fourth engineers take charge of the engines in turns in watches of four hours on and eight hours off. The fifth, sixth and seventh engineers attend to the boilers and the stroke-holes, their watches also lasting four hours. For attending to the bilge pumps and similar work, the eighth and ninth engineers take turns in watches of six hours, and the tenth engineer attends to the deck machinery. The firemen, coal-trimmers and greasers work in watches of four hours with eight hours off duty.

The ship is lighted all over from forecastle to shaft-tunnel by Edison incandescent lights. The dynamos are run by two independent engines. One of the latter knocked out a cylinder head while in Liverpool, and one engine did all the work. From stem to stern the vessel is a credit to her builders, John Elder & Co., Glasgow, Scotland.

The annual meeting of the American Society of Mechanical Engineers, will be held in the rooms of the American Society of Civil Engineers, 127 East 23rd Street, New York, beginning Wednesday evening October 31st. A large attendance is expected, also a number of practical papers on mechanical subjects will be presented. It is understood that a goodly number of new names will be added to the membership.

LETTERS FROM PRACTICAL MEN.

Three-Center System of Holding Work.

Editor American Machinist:

In our experience in building a new machine and in building up a business at the same time we have had to do what many another firm with limited means and unlimited aspirations have had to do, that is, scheme out cheap and simple devices for accomplishing ends that old established firms would have special and costly machines for doing in a systematic manner. One of the jobs we had to provide for was planing and boring connecting rods, and the devices used have proved so serviceable for the special purpose designed, and are applicable to so many other uses, that it is thought others may profit by their adoption. The key-note of the whole scheme is *holding things on three centers* instead of two. The gain in convenience is simply immense. After the three center holes are drilled in a piece it is fixed for holding, whatever the character the work to be done on it may be.

Figs. 1 and 2 show the application of the rig for holding a connecting rod for planing. When the work is done on one side, slacking back one set screw allows it to be turned over, and when made fast for planing the other side it will be true, and the two sides when finished will be parallel.

The same two-center rig, secured to the angle plate of a shaping machine, holds the rod for planing the end, or fastened to the vertical face of the radial drill, or an angle plate on a common drill, makes a simple and secure rig for holding the rod for boring the stud holes.

Fig. 3 shows the application of the same principle to boring connecting rods. The same center holes used for planing serve to hold the rod for boring both ends. For all we can see the boring done with this rig on an ordinary drilling machine is in every way as good as if done on a costly boring machine, and the time expended in setting is much less than is usually consumed in securing such pieces to angle plates on a boring machine.

To give the system range for extensive application requires a number of the two-center pieces, and if these are all exactly the same height from the bottom, the one single-center does for everything.

A more complete arrangement would be to have the two-center part made with adjustable heads to set at any distance apart, but in either case there should be a wide base provided for securely fastening to the planer bed or angle plates. JOHN E. SWEET.

Merits of Slide-Valve Engines.

Editor American Machinist:

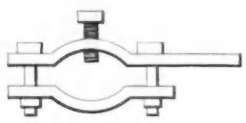
It would be almost rank heresy to impugn the economy of automatic engines, and there is no real intention of so doing in this communication; but the day is not yet come when a good slide-valve engine, properly proportioned and built, can under all circumstances be profitably set aside for its aristocratic brother.

There can be little dissent from the proposition that much of the success of automatic engines, as built by the best makers, is attributable to and dependent upon the perfection of proportions and workmanship of the engine as a machine.

An engine out of line, with small shaft, crank-pin, and short bearings, with imperfect fits and deficient strength in the line of strain, cannot be satisfactory, no matter how perfect or fine-spun the theory of its government or regulation. The ports must be large, the slides ample for their work, the crank and crosshead-pin of full size and *true*, the shaft and its bearings sufficient to lubricate and run cool under maximum duty. Now, if the same care is bestowed upon the essentials of the slide-valve engine, the most economical proportions of the valve and its seat adopted, good regulation obtained and perfect performance from the beginning assured, the reduced first cost will, with reasonably cheap fuel, go a considerable distance toward meeting the advantages of the automatic engine. The additional constant cost of expert engineers and current repairs is also to be considered as in favor of the simpler engine.

Perhaps the use of the term "slide-valve engine," as contrasted with automatic engines, may be misleading. A great number of strictly automatic engines are being built to-day with a plain slide-valve controlled by a governor on the main shaft. I have been surprised, however, by a statement recently made (I forget the author) that after the tests made at Cincinnati, in which the Wheelock engine figured so favorably, some local builders put in a good plain slide valve engine, with a throttling governor, and obtained results in regulation and economy, which compared very favorably with the performance of the automatics previously tried. I had not heard of this trial, but as it could hardly have been made without Mr. Hill's knowledge, won't he give us his recollections of the matter?

You see I am building a good straightforward, no-nonsense kind of a slide-valve engine, and therefore have my axe to grind if I can hold my theory to be approximately correct. H. R. B.



screw, the work skipped along in lovely shape. The rig looked like the above sketch. SHARP.

Cheap Lights for Shops—Valves and Valve Seats.

Editor American Machinist:

As there are, in the country, many shops that do not enjoy the luxury and convenience of gas, the following plan, which I have seen used in several shops, may be of interest:

Take a piece of gas-pipe of, say 1½ in. diameter, and of any length that may be convenient, and in a straight line drill a row of holes of about one inch diameter and from four to five feet apart. After brightening the iron around the holes, take a soldering-iron and tin the surface, and then solder a common kerosene burner over each hole—of course taking care that the burners stand in line. Then put a cap over one end and an elbow on the other end, looking up. Through this elbow the pipe can be filled at any time, even when the lights are all burning. When filled, the elbow can be stopped with a plug.

Now, by suspending the pipe over the bench, or over lathes, you have a good, cheap light, without fear of an explosion, as the large quantity of oil in the pipe between the burners keeps it cool, and even when the oil is low there is no generation of gas.

I have noticed in the AMERICAN MACHINIST several sketches of valve seats that were badly cut or worn hollow. This has been accounted for by there not being sufficient bearing surface. All this reminds me of a difficulty I have encountered, and which I would like to have some of your readers explain. It may go some distance towards explaining the cause of valve seats wearing as they do.

Several years ago, the firm that I am with used a round piston valve, taking steam in the center and exhausting at the ends, the ports going entirely around the valve chamber, so that the valve was as nearly balanced as possible. It could be moved by the finger with the full pressure of one hundred pounds steam on. After a year or so it began to leak steam, and we found that the seat had worn hollowing, although the valve had retained nearly its original shape. The firm then adopted a flat valve, planed and scraped on both sides, and placed under a back plate which rested on two ledges at each end of the valve. In fitting, these ledges were scraped down until steam would not blow through. We now thought that we had got it right, as the pressure would be all on the back plate, and, like the round valve, it moved very easily under full pressure. But there was wear; and I have seen them that were cut as badly as I ever saw a common valve, and even where the wear had been gradual, in time they would blow through, and it would be found that they had worn hollowing, like the other.

I have often noticed, in starting up a new engine and boiler, that fine particles of sand or grit would come out of the cylinder cocks, more than could be lodged in the steam passages of cylinder. I have thought that the particles of rust and impurities that might be in the boiler were carried by the steam, and as they passed through the ports lodged and cut the face of the seat. This may not do it all, but it may be the starting point, and I am not sure that it is not an important one, as I think that as a general rule the valve seat will be found the lowest at some point on the bridges. H. REYNOLDS.

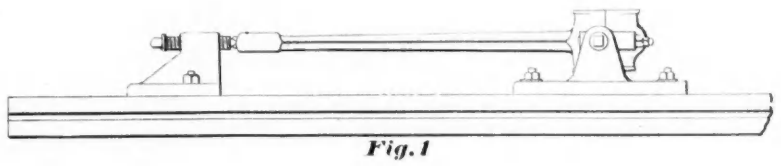


Fig. 1

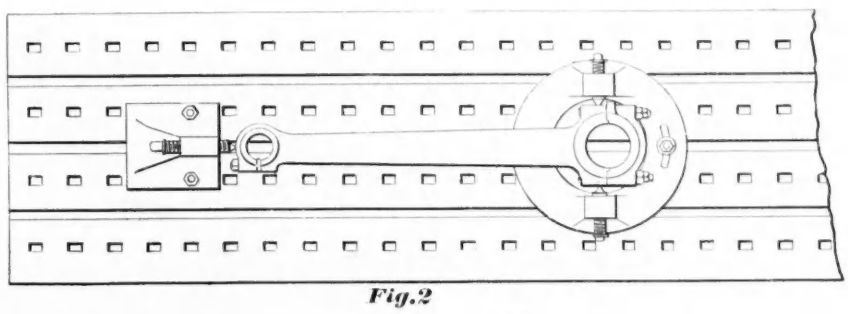


Fig. 2

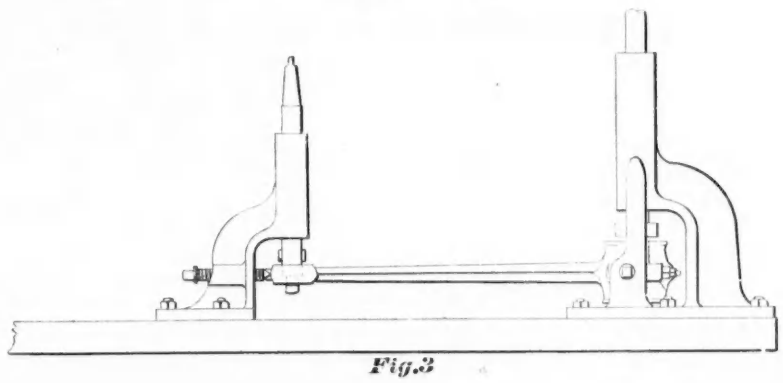


Fig. 3

Some Shop Kinks.

Editor American Machinist:

It was a plate; it was in the chuck. It had been faced off, and was to be faced off again true with the old surface. Round and round it went, but it would not run true. Good hammering was of no avail; chalk wasted into insignificance, and I could see the temper rising in the man who had it in charge. But some happy thought strikes him, for he smiles, and, stopping the lathe, he places in the tool-post a tool with the butt extending to the work. He loosens the chuck jaws until they hardly hold the work, then runs the tool easily against the plate, the same as in square centering, and lo! it runs true as heart could wish. After that lesson I always kept my eyes askant for jobs where I could use this method, and I found that other chuck work could be trued in the same manner.

I have seen this same fellow using clamps made from two pieces of flat iron, 1″x3″, bent and bolted together, on a shaft 4″ diameter. He started a big cut and the clamps slipped, as clamps usually do. The efforts of a four-foot wrench on the bolts produced the desired friction for a few minutes, when away it went. Well, he tried chalking the shaft, emery paper under the clamps, but to no avail; it would slip. Then he took off one side of the clamp, drilled a hole in the center of the crook and put in a set screw. When he tightened the bolts, and set up the set

The Biter Bit.

A good story is told of the well known engineer, Wm. A. Sweet, of Syracuse, N. Y. Casually meeting a prominent lawyer one day, a brief conversation ensued, in the course of which Mr. Sweet happened to ask "the Judge" what he thought of some question they were discussing, without really meaning to ask legal advice in the usual way. Soon afterwards Mr. Sweet received a bill from the Judge, "for legal advice, one thousand dollars," which he paid promptly without a word of complaint.

Time passed on, and one day the Judge, who was also heavily interested in salt manufacture, needed some mechanical advice about some machinery, which was not running satisfactorily, and asked Mr. Sweet to look at the machines and tell him what was needed. Mr. Sweet looked them over for two or three hours, and indicated the cause of the trouble. When he went home he promptly made out a bill against the Judge, for "mechanical advice, fifteen hundred dollars," and the bill was duly paid, furnishing probably one of the few instances on record in which mechanics ever got ahead of the law.

All the locomotives belonging to the Central Railroad of New Jersey are being equipped with the extended smoke box as fast as they can be taken into the shops for that purpose. On this road, and on all railroads in this region where the extended smoke box has received a fair trial, it is spoken of very highly as a means of preventing sparks. Its success has been uniform on our best managed roads. Where the extended smoke box fails to give satisfaction as a spark arrester, the inference is that the failure is due to mismanagement or prejudice. The latter feeling continues to be more potent than reason in many quarters.

We recently received a call from Mr. Charles Fairbairn, a mechanical engineer of Manchester, England, a relative of the famous engineer, Sir William Fairbairn. Mr. Fairbairn has gone to visit friends in Canada, and he expects to spend a few weeks in the United States. He is the inventor of a machine for making screws by rolling hot. Several screws which he left in this office show excellent work. The threads are as clean and regular as the ordinary cut threads.

The Sanitary Engineer, referring to efforts to scare the public about conveying disease through circulating second-hand books, closes an editorial as follows: "The probability of infection by books, or bouquets, or *faience*, is not any greater than the probability of death from a runaway team, which we incur every time we go into the street. We have no desire to underrate the importance of attention to all preventable causes of disease, but there is such a thing as straining at a gnat and swallowing a camel in sanitation as well as in morals, and it is to the inexpediency of this that we wish to call attention."

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☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, NOVEMBER 3, 1883.

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A Change in Price.

Six years ago this November the first issue of the AMERICAN MACHINIST made its appearance. In our introductory we said: "We propose to make this the standard machinery newspaper of America, and to this end shall direct all our efforts." The success of the venture was far beyond our original expectations. Year by year the paper has continued to grow in the favor of the mechanical public, as our readers well know, by their own observation. Part of this remarkable success is due to our determination announced in the first issue and strictly adhered to ever since, not to publish a notice of anything in our reading columns for pay or in consideration of advertising patronage; also to mind our own business carefully and leave our neighbors to attend to theirs as best suits them. The AMERICAN MACHINIST has been sustained by the public as no other mechanical journal ever has been in this country. It is read not only in every part of the United States, but in every civilized country in the world. To gain a still larger number of readers, we have decided to reduce the price of the AMERICAN MACHINIST to five cents a copy, or $2.50 a year, beginning with this issue. We have never heard a complaint that six cents a copy or $3.00 a year was too high a price, but believe the new price a more popular one. In making this reduction, it is proper to announce to our readers that every newsdealer will receive the paper *one cent a copy less than before*, thus suffering no loss whatever by reason of the lower price, also that no one employed by us will have his pay reduced in consequence of this change. In most mechanical industries every dollar is a little harder to obtain than it was a year or two ago, and as we expect an increased circulation will make up all loss to us growing out of this reduction, we are glad that all our readers are to receive a benefit.

In regard to circulation, we present the following affidavit which explains itself:

NEW YORK, Oct. 16th, 1883.

I have printed every issue of the AMERICAN MACHINIST for the past five years. When I began to print the paper, its circulation, as a monthly, was only 5,000 copies. When it changed to weekly issue, its circulation was 7,000 copies; since then its growth in circulation has been remarkable, surpassing anything of the kind in my experience. For at least six months past I have printed not less than 16,000 (*sixteen thousand*) copies of the AMERICAN MACHINIST each week.

Signed,

J. W. PRATT.

Sworn before me) this the 16th of Oct., 1883.)

JOHN H. MORRIS,
Notary Public,
City and County of New York.

The Machine Tool Industry.

Machine tools are cheaper, as a rule, than they were a year ago. Railroad companies and shrewd buyers for other shops have been making contracts at the reduced figures in anticipation of firmer prices, with possible advances. Many, however, have been looking for still lower prices. There is no reason to apprehend any such ruinous prices as prevailed six or eight years ago. Shops had then been building tools in quantities ahead of the demand, and the accumulation of stock was an element of weakness that could not be explained away to the satisfaction of buyers. The policy of machine tool builders has changed since then. They will shorten hours of running, reduce force, or turn their attention to other kinds of machinery, rather than accumulate tools in the hope of a future demand. Shop systems have been so improved within five years that the actual cost of producing tools can now be closely determined in shops doing the most business, and in many of the smaller ones. Formerly, the selling price of each machine was based largely upon guesses as to the cost of producing it. Sometimes these guesses proved to be wide of the mark, in such cases almost always on the wrong side for the tool builder. Losses and occasional open disasters were the outcomes of such a policy. Some establishments fixed prices to meet those offered by their competitors, not because they were obliged to sell, but because they believed themselves able to make and sell tools as good and as cheap as any others in the business.

Since then the capacity to build machine tools has increased extensively. At least three times as many establishments are in the business and most of the older shops have been enlarged. Two years ago the demand was ahead of the supply, now the capacity to build tools is ahead of the demand. In an old and fully settled country such a situation in the tool building industry would be far from assuring, unless an active foreign demand could be depended upon. In this country, a large portion of which is still unsettled, it signifies nothing more than this: the logic of events shows that greater caution should prevail in deciding to start new tool building establishments or to further enlarge those now in operation, until the extension of new industrial enterprises requiring tools gives a fresh impetus to the demand.

Accountability for Boiler Explosions.

It is altogether a healthy sign that the recent activity in boiler explosions has failed to bring anything like the usual number of those ready with some hypothesis in explanation, in which the mysterious predominates. Unquestionably in the past such explanations have had influence in strengthening opinions quite too common that there is some sort of providential dispensation in the matter of boiler explosions that places their prevention outside the restraint of common prudence and decent care. The fact that those who have heretofore labored to strengthen such opinions have changed their belief, or even that they are constrained to forego the discussion of what they still believe, is encouraging.

Boiler explosions increase in frequency rather alarmingly from year to year as the number of boilers in use increases, but mainly because owners and users fail to learn wisdom from experience. The best way to check this increase is to satisfactorily demonstrate that there is never anything more mysterious about a boiler going to pieces than there is about the breaking of a rod of iron by the application of sufficient force. By mysterious we mean anything other than the *natural* increase of pressure beyond the present strength of the material to resist. If a sound rod breaks under a certain strain no one would expect one originally of the same dimensions but half eaten away to withstand the same strain, but apparently this is just about what is expected of a boiler. If the weaker rod breaks under one-half the strain no one will feel called upon to invent some theory to explain why it broke.

If from the total number of boiler explosions those are subtracted in which the causes are, or may be, made entirely plain, the basis upon which to establish mysterious agencies will be extremely limited. It will not be necessary to bring forward any new theories whatever. Those already in existence will more than go around. The sooner it is universally appreciated that there is no room for the element of chance about a boiler explosion, the better the prospects that boiler explosions will not occur. Holding some one to accountability will then be the logical rule, and at the same time the end, substantially, of criminal blundering in this respect.

There is no way by which all the superstition can be so quickly brushed away as by a rigid investigation of every case of boiler explosion, and a complete exposure of the cause—not for the benefit of a few more directly interested parties, but for the instruction of all. Covering up or suppressing facts because they are ugly is not what is wanted. The subject needs all the light that can be shed upon it. So far as this is done it is instructive as well as suggestive to find the cause to be, almost universally, incompetency or gross carelessness, or both combined. It is not always right to lay all the blame for incompetency or carelessness upon the engineer or fireman in charge, because in the majority of instances it is part of the owner's system, or lack of system. When safety valves are found to have been overloaded, or leaky boilers continued in use, something may frequently be found by looking beyond the engine-room for the reason. "Don't screw your safety valve down, Bill," said the captain, not of a Mississippi but of a North River boat, "don't screw your safety valve down, but don't let anything get by you for the lack of ten pounds more steam."

The industrial exhibition award season has only fairly begun, yet one or two interesting features have been developed. The St. Louis Exhibition managers have introduced an innovation upon the time-honored custom of brass medal and cheap lithograph awards, by conferring blue ribbons upon those exhibitors whose productions are deemed worthy of special distinction. At first blush the blue ribbon award might seem trivial, but when the astonishing growth of prohibition sentiments in the West is considered, its importance will be better understood. Its value may be estimated by an incident that occurred at the close of the fair. The night after the machinery awards had been made "some low-down, evil-minded fellow" (we quote from a St. Louis contemporary) stole and carried off all the blue ribbons awarded to a machinery firm of that city. Who ever heard of a thief periling his liberty by carrying off a brass token or pasteboard diploma awarded at an Eastern exhibition? The blue ribbon is both ornamental and useful, and the disappointment of the St. Louis machinery firm over their loss may be imagined. The profits on machinery are smaller than they were two or three years ago, and extra expenses have to be carefully looked after. Being agreeable to customers sometimes involves a few "smiles," and consequent expense. Blue ribbon men, as everybody knows, are exempt from such depletions of their ready cash, therefore have some advantage in conducting business economically. The firm that lost their blue ribbons of course lost this advantage, and will be expected to "set 'em up" for customers just the same as before the fair. We commend the blue ribbon award to the managers of Eastern industrial exhibitions (where awards are given) as more in keeping with the spirit of progress than the gew-gaws they annually distribute.

Literary Notes.

RECENT LOCOMOTIVES. ILLUSTRATIONS, with Descriptions and Specifications, and Details of Recent American and European Locomotives. Reprinted from the *Railroad Gazette*, 73 Broadway New York.

This book contains in an excellent form a complete record of locomotive engines for the last three years. All inventions of value or of general interest are illustrated and described, those of foreign make being well represented. To the student or practical man who wishes to keep posted regarding improvements and experiments upon the locomotive this book will prove a good medium of reference. Besides illustrations and descriptions of all locomotives possessing new or interesting features, the book contains many details that are valuable to railroad men. Indicator diagrams, details of valve motion, method of applying the indicator to locomotives, and numerous other particulars about locomotives are given. The Walschaert and the Joy valve gear are shown in a way that any draughtsman could copy for practical application if necessary. Many other engravings give details that can be conveniently copied. There are several illustrations that are interesting if they cannot be

termed useful. Among these may be mentioned the Fontaine Engine, A Remarkable Collision, and Dignity and Impudence. The book gives a good opportunity for comparing American and foreign locomotives, and to many men it will be useful in showing the diversity of designs among our own roads.

WORKSHOP RECEIPTS FOR MANUFACTURERS, Mechanics, and Scientific Amateurs. Second series. By Robert Haldane. E. & F. N. Spon, 35 Murray and 60 Church streets, New York. Price, $2.00.

This is a book of 485 pages of receipts for a variety of purposes. While on the whole it is more especially devoted to the use of amateurs and manufacturers, there are at the same time many things of interest to individual workmen, and even in the house. It is thoroughly indexed, making it very convenient of reference.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(342) W. I. W., Warren, R. I., asks: Does a locomotive engine ever work as high as 1,000 horse-power? *A.*—Frequently much higher, how much we cannot say.

(343) A. E. K., Detroit, Mich., asks: Will you please name some of the best smoke consumers in use, and where they are manufactured? *A.*—We have not heard accounts from any so-called smoke consumers that would warrant their recommendation.

(344) A. L. W., New York, asks: Where can I get complete drawings of a beam engine? *A.*—We know of no way except you get them made by a competent draughtsman. Possibly you could obtain copies from some works where such engines are built, but this would depend largely upon what you wanted of them.

(345) C., Kansas City, Mo., asks: 1. What is the object of the double port in the Worthington steam pump? *A.*—We suppose it to be for the purpose of cushioning the steam piston by means of the piston covering the port through which steam is exhausted. 2. What will be the temperature of air compressed to 10 pounds above the atmosphere, from an initial temperature of 68°? *A.*—If there is no loss of heat, about 145°.

(346) T. R. S., Morgan City, La., writes: I am running three superheating boilers. One has a dent about four feet around, and in places ½″ deep. I find nine places dented in the three boilers, none of the other dents, however, being as large as the one first mentioned. Can you tell me the cause? *A.*—We cannot even suggest the cause without knowing more of the circumstances. We should say, from what you write, that it was a case requiring early inspection, as the condition may be dangerous.

(347) W. H., Harrisburg, Pa., writes: I would like to know what lap lead and travel to give a valve for a 10″x12″ engine, the engine to run 80 to 100 revolutions. The steam ports are 1 1-16″x4½″; exhaust port, 2⅛″x4½″; bridges, 27-32″; steam chest, 11⅜″ long? *A.*—The ports are badly proportioned, being not more than one-half as long as they should be. We should say that as well as you could do under the circumstances would be to make the outside lap of valve ¾″; inside lap, 1-16″; lead from 1-32″ to 1-16″; travel of valve, 3⅝.″

(348) F. D. W., Madison, Wis., asks: 1. What is about the average royalty paid to an inventor, particularly on agricultural implements? *A.*—It would be impossible to give the average. The royalty that an inventor will be able to get will depend upon the value of his patent and his ability to make a bargain. 2. Which party usually defends the patent, the owner of it or the party who pays royalty? *A.*—The owner. 3. What literature can I get on the subject of patents? *A.*—Write to the Patent Office for copy of the Official Rules and Regulations.

(349) S. B., Boston, Mass., writes: I have a large mirror that has been heated in one spot so as to destroy the silvering and ruin the looks of the glass. Can it be fixed, and if so, how? *A.*—It is a difficult thing to do satisfactorily. Perhaps by inquiry you can find some one to do it. If not, you can try the following: Thoroughly clean the damaged part by rubbing gently with a piece of cotton, then with a knife carefully cut around a piece of the silvering on another glass. Upon the surface cut around, place a small drop of mercury. This will spread and loosen the piece cut around, which is then to be carefully lifted and placed on the damaged place. The piece cut around should be a little larger than the place to be repaired. After lifting and placing the piece it should be lightly pressed down with cotton. If the place to be repaired is large, you will have to do it with more than one piece, as you can handle only a small piece at a time.

(350) W. G. S., Pittsburgh, Pa., writes: Will you please give me a little advice? I have an arrangement for pulling a large cinder truck out of a pit, the grade being 1″ to the foot. I have a windlass for doing this, in which there is a 12″ crank on one end of a small shaft and a small gear wheel on the other end. This wheel gears into a large wheel, the proportion being 2 to 1. On the other end there is a worm, ½″ pitch, working in a wheel with 56 teeth, this wheel being keyed to a 2⅜″ shaft. On this shaft is a rope, which winds on the shaft and pulls the car out. This is all right. But it is too slow, and I cannot lose any of the power I have got. Would it be any better if I should make the bevel wheels 5 to 1, and put a 3″ chain wheel on the same shaft with large gear wheel, and a 16″ wheel on 2⅜″ shaft, running with a chain in place of worm and worm wheel; or would it be better to put a worm and worm wheel in place of bevels and still use the chain, making the worm double thread? *A.*—You say you cannot lose any power, by which we infer that you do not wish to work any harder at the crank. This being the case, either of the arrangements you propose would not be satisfactory. It is simply a question of whether you are willing, or able, to use more force at the crank, and how much more. By the first alteration named, for the same number of revolutions of crank you will move the car four times as far as at present, but the work done on the crank will be four times as much. By the second plan, if we understand you, the ratio can be whatever you may make it, but what you gain in time you will lose in power.

(351) G. E., London, Ont., writes: In the rules that are given for calculating the horse-power of a steam engine from indicator diagrams, there seems to be no consideration of the fact that the effectiveness of the pressure in a cylinder depends greatly upon what part of the cylinder the piston may be in when the pressure occurs. For instance, take a cylinder 8″x12″, and suppose the cut-off to take place after the piston has traveled 3″, the result being a mean effective pressure of 30 pounds. Now, by an alteration in the valves cut-off at 6″ or ½ stroke, getting, say, a mean effective pressure of 60 pounds. According to the rules, the power developed will be in the latter instance twice as much as in the former, but I think it will be far more than that, as the pressure for the first three inches is not nearly so effective as in the second three inches. To make it plainer, suppose we exert a pressure of 60 pounds for three inches from the commencement of the stroke, and then there is no pressure; and, again, suppose exactly the same conditions for the three inches when the piston is nearest the center of the cylinder. According to the rules, the horse-power will be the same in eac instance, but I think it will be two or three times greater for the middle three inches, because the piston is then traveling two or three times as fast. If I am wrong I would like to know why? *A.*—There is, theoretically, no error in calculating diagrams as they are commonly calculated. The speed of the piston, by which you multiply, is the average speed, and the pressure is the average pressure. Taking your last example, it is true that a given pressure is more effective for the time it is exerted when the piston is near the center of its stroke, but for three inches travel there it is not exerted for so long a time as for three inches from the end of the stroke. In other words, while the piston is traveling three inches from the end of the stroke, the crank pin (which may be supposed to have a uniform velocity) moves much further than when the piston is traveling the three inches nearest the center of the cylinder, and the effect of the pressure into the time it is exerted is the same in one instance as the other.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Match Machinery, F. Chillingworth, New Haven, Ct.

F. VanWinkle, Mech. Engin'r, 22 Cortlandt St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Improved Tack Machines,
Taunton Cotton and Machine Co., Taunton, Mass.

"Tack Machinery"
Willets Manufacturing Co., Providence, R. I.

4x4 engines, stationary or marine. N. C. Heaton, 332 Water street, New York.

The latest Improved Match Machinery is made by the White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh Wells, & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C.C. Hill, 144 LaSalle st., Chicago, Ill

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 58,) New York City.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Jack pump and ladder chain machines, 40 to 80 links per minute, direct from coil. The Gaylord, Cross & Speirs Company, Waterbury, Conn.

William J. Baldwin, consulting engineer in Steam Heating and Ventilation. Author of "Steam Heating for Buildings." Office, 96 Fulton st., New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880, 1881, and 1882. A limited number of each sent by express for $3.50 per volume, express charges to be paid by purchaser. AMER. MACHINIST Publishing Co., 96 Fulton st., New York.

Business men furnished stenographers, who are machine operators, without charge for my services. Shorthand taught by mail. Caligraphs sold; special inducements offered; correspondence solicited. W. G. Chaffee, Oswego, N. Y.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address, in the United States, by mail for one dollar. To Canada and foreign countries 75c., the purchaser to pay custom-house duties and express charges. American Machinist Publishing Co., 96 Fulton street, New York.

"HOW TO KEEP BOILERS CLEAN."—A book of seventy-two pages, telling how to prevent scaling, foaming, priming, and burning, with other valuable information, will be sent to any address FREE of postage, by James F. Hotchkiss, 86 John street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. AMERICAN MACHINIST PUBLISHING COMPANY, 96 Fulton street, New York.

Slide valve working models, $2 each. Full size working drawings for making same, 25 cents. Shows effect of lap, lead, expansion, cushion, &c., at a glance. See notice in this paper, Vol. 6, No. 41, page 9. Will forward on receipt of money or stamps. Also "Useful Hints on Steam," 96 page book, mailed for 15 cents. E. E. Roberts, manufacturer of engines and boilers, 107 Liberty st., N.Y.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

MANUFACTURES.

The shops of the Holyoke Machine Company, Worcester, Mass., are to be enlarged.

Twenty cotton mills in Alabama are paying an average of 15 per cent. per annum in dividends.

The New York Tartar Company will erect a $35,000 factory on Ninth street, Brooklyn, E. D., N.Y.

The Marshall (Tex.) Foundry and Machine Company are about building a 75x115 feet wheel foundry.

The shops which the Chicago, Alton and St. Louis Railroad is now building at Bloomington, Ill., will cost $150,000.

Cooper & McKee, Brooklyn, N. Y., will erect a factory on Middleton street, near Harrison avenue, to cost $10,000.

A company has been formed at Chartiers, Pa., to build a sheet iron rolling mill. A site of four acres has been obtained.

The Taunton Locomotive Works are at work night and day on a large order just received for the Union Pacific Railway.

The Fowler Manufacturing Company are about to erect a brick factory on Twenty-third street, near Eleventh avenue, New York, to cost $33,000.

The Yadkin Falls Manufacturing Co., Concord, N. H., have begun the erection of a new factory building. It will be 100x52 feet, and two stories.

The Hamilton Machine Works, Youngstown, O., according to the *News-Register* of that city, have reduced the wages of their employes ten per cent.

The Paper Mills at Holyoke, Mass., are running on about one-half capacity, on account of the low water. Prices of paper have advanced correspondingly.

The new building for the rolling mill of the Haxtun Steam Heater Company, at Kewanee, Ill., is 75x200 feet, with an L 60x75 feet, and it is built entirely of brick.

The A. Burritt Hardware Company, Waterbury, Conn., are erecting a malleable iron foundry 175x50 feet, and a building for finishing steam and gas fittings 200x35 feet.

Stone, Lockwood & Co. intend to build a mill and wood-working establishment of considerable capacity at Claremont, on the lower James River, Virginia.

Fred Smith, Tonawanda, N. Y., will erect a new saw mill, planing mill, sash, blind, and door factory.

The Cheshire, Mass., Watch Company has been organized with a capital of $100,000. A recent town meeting voted to exempt the company from taxes for five years.

An enterprise of large promise on the Pacific coast is the lately incorporated Pacific Steam Manufacturing Company, of San Francisco, with a capital of $5,000,000.

The Russell & Erwin Manufacturing Company, New Britain, Conn., are building a new foundry 230x80 feet, a finishing shop 133x44 feet, and other important additions to their extensive works.

Skunk Lake, Cheboygan County, Mich., bids fair to have a saw mill on the co-operative plan to saw up the five million feet of pine that is said to stand in that vicinity. Some 30 or 40 Lakers have subscribed $25 each to start the enterprise.

L. S. Graves & Son, of Rochester, N. Y., have recently added to their works a new brick building, 54x40, three stories high, and filled it with new shafting and pulley machinery manufactured by the Niles Tool Works, of Hamilton, O.

The United States Rolling Stock Company has commenced work on its new shops at Calumet, Ill. Two thousand feet of side track will lead directly to the site. Some $300,000 will be expended for buildings. The place is to be called Hegewisch, in honor of the president of the company.

The report of the trial of the Gaskell Pumping Engine at Saratoga Springs, June, 1883, by Charles T. Porter, has been published in pamphlet form by the Board of Water Commissioners of that village. It is very complete, and shows a high duty for the engine.

Grant & Bogert, Flushing, N. Y., have taken a contract to make all the iron castings required by the New York Heating and Power Company. They have received an order for two of their new style milling machines from Lorillard's Tobacco Works, of Jersey City, and for six from a Western shop.

The Hennesey boiler, illustrated in the AMERICAN MACHINIST two years ago, has met with success. About forty have been built and are in operation. The Hawkins Iron Works, Springfield, Mass., are now building six Hennesey boilers, two of them being of 80 horse-power each. This boiler is also made in Chicago, Holyoke, and Boston.

John McLaren, Hoboken, has five or six Allen engines in course of construction, besides some plain slide valve engines and air-compressing machines. Business is rather quiet in the machine shop, but the boiler shop is quite busy. Here besides several boilers partly finished, there is a number of large double cylindrical tanks being built for the purpose of manufacturing concentrated artificial manure.

The Grant & Bogert Machine Tool Works, Flushing, N. Y., are building a milling machine on an order, which is to weigh about twelve tons and stand about twelve feet high. It will be arranged to mill side rods, links, and the jaws of locomotive frames. It will also bore a cylinder, face off a flange, index and drill the holes for the starting bolts, face off the valve seats and mill the edges of the ports, also perform other operations.

The Pond Machine Tool Company, Worcester, Mass. (David W. Pond, president, and A. C. Stebbins, secretary and treasurer,) have issued a small illustrated pocket catalogue of metal-working machinery and supplies. It includes not only the well-known machine tools manufactured by themselves, but a selection of tools and supplies of other good makers. The catalogue of 119 pages will be mailed to any one interested in buying tools.

The *Denver Journal of Commerce* says: Here in Colorado the workers in iron are the most prosperous. Every forge and furnace and lathe is employed, taxed to their utmost to meet the demands made upon them for milling machinery. The clatter of a thousand hammers is heard within ten minutes' walk of where we write, while the smoke from the great chimneys in the lower city darkens the view. The demand for mining machinery was never so great as now.

As an example of the perfection reached by trade catalogues in artistic illustrations, finely engraved and faultlessly printed, the new turbine water wheel catalogue (72 pages) of Poole & Hunt, Baltimore, Md., takes front rank. Everything about it is in good taste from the first page of the cover to the last. Various forms of wheel setting are shown, and the explanations are clear, concise, and specific. The natural inference is that an establishment that takes extra pains in representing their machinery upon paper, also takes extra pains in manufacturing it.

The *St. Louis Age of Steel* says of trade in that city: "Stove works are all busy and still behind their orders. Architectural iron works are fairly busy. Machine foundries are running slack. Pipe foundries are overtaxed and behind orders. Chain and malleable iron works are moderately well supplied with orders and are running steadily. White lead and oil works are busy. Boiler works are short of orders, and are doing repair work principally, but business is reported picking up. Among machinery dealers business is best with those handling agricultural and saw-mill machinery; and local manufacturers of this kind of machinery are all busy, including makers of circular and other kinds of large saws. Trade in wood-working tools generally and in iron machine tools, however, is quiet—very quiet as regards the latter, but with a slightly improved outlook for the former."

Machinists' Supplies and Iron.

NEW YORK, October 18, 1883.

There is no especial change in the supply business. In American iron the demand is unsatisfactory, with a tendency to slightly reduced prices. Consumers seem determined to buy only for immediate use. We quote: Standard brands of No. 1 X Foundry at $20 50 to $21.50; No 2 X, $19 to $20.50.

There are but few transactions in Scotch pig, with sales of Coltness, $23.25; Glengarnock, $23; Gartsherrie, $23.50; Summerlee, $22.50; Eglington, $20.50. These prices are at yard; in most instances lower prices are quoted to arrive

Antimony—Hallett's, 9c.; Cookson's, 10¼c.

Copper—Lake, 15c. to 15¼c.; other brands, 14⅜c. to 14¾c.

Lead—Common pig is firm at 4.20c.

Spelter—Refined, 8c. to 8¾c., with market quiet but steady.

Tin in jobbing lots—Banca, 21¾c.; Straits and Malacca, 20⅞c. to 21c., with light sales.

Boiler plate, in small lots—Tank, 2¼c. to 2¾c.; Refined, 2¾c. to 2 5-10c.; Shell, 3¼c. to 3⅜c.; Flange, 4¼c. to 4½c.; extra Flange and Fire Box, 5¼c. to 5½c.; Siemens Steel Plate, 5½c. to 6c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

A mechanical draughtsman of good technical education and experience, desires a situation. Address, Draughtsman, P. O., D 38, New Haven, Ct.

Situation wanted by a first-class mechanical draughtsman and engineer. W. Metcalf, 47½ Willow street, Brooklyn, N. Y.

A machinist of ten years' experience on jigs, tools, &c., for milling, drilling, and screw machines, desires a situation. Address J. A. B., this office.

Wanted—An experienced foundry foreman; must be experienced on general jobbing, handling men, &c. Address, stating age, experience, reference, &c., "Melter," care of AMERICAN MACHINIST.

Wanted—Permanent position by a mechanical draughtsman of good technical education and experience in modern machine tools and steam engines. Address Box 14, care AM. MACHINIST.

Draughtsman is open for engagement to design marine engines or general engine work. Has superior ability, theoretical knowledge, and long practice within this line. Address Draughtsman, AM. MACHINIST.

A mechanical draughtsman, experienced in designing machinery and superintending its erection, desires a situation. Specialties: Motive power, pumping machinery, and mill work. Address P. O. box 326, Moorhead, Minn.

Wanted—Parties traveling for other houses and selling to users of steam boilers, to take charge of a small and fast selling article; good references required and the kind of trade solicited. Address "Manufacturer," care AM. MACHINIST.

First-class mechanical draughtsman and engineer, graduate; able to construct any kind of machinery and buildings (experience in general machinery, tools, sugar, glucose, breweries, ice-machines, &c.) desires situation. Address I. K., 125 Clark street, Room 40, Chicago, Ill.

A reliable and competent mechanic desires a situation as superintendent or foreman. Experienced in management of shop and men, designing and constructing tools, fixtures, etc., for the economical manufacture of duplicate, or interchangeable work. Good references. Address, Box 2, AMERICAN MACHINIST.

Manufacturing property for sale, 30,000 feet floor space, competing point for four trunk lines railroads, switch from door. Write for terms and description B. W. Payne & Sons, Corning, N. Y.

Wanted—Some wide-awake concern to manufacture chain blocks and cranes of all kinds under recent patent. Correspondence solicited. Address, Box X, care AM. MACHINIST.

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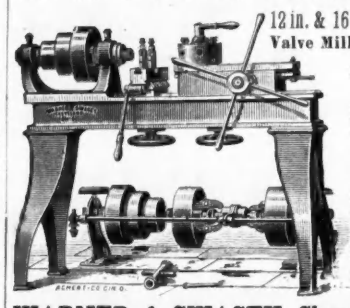
BRASS WORKING MACHINERY.



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Double Key Lathes, Speed Lathes Slide Rests Revolving Chucks for Globe Valves, Two-Jawe Chucks, Small Tools and Fixtures.

WARNER & SWASEY, Cleveland, O.

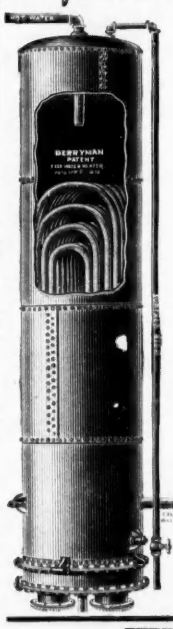
"COMPOUND" BOILER;

HOW TO USE IT AND RUN IT AT SEA.

Explaining causes of all corrosion and the formation of scale, with instructions for its entire prevention, together with useful information for maintaining Steam at Sea. Illustrated. By a Sea-going Engineer. 8vo, paper, 40 cents.

E. & F. N. SPON, 35 Murray St., N. Y.

THE Berryman Pat. Feed Water Heater & Purifier



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I. B. Davis & Son, HARTFORD, CONN.

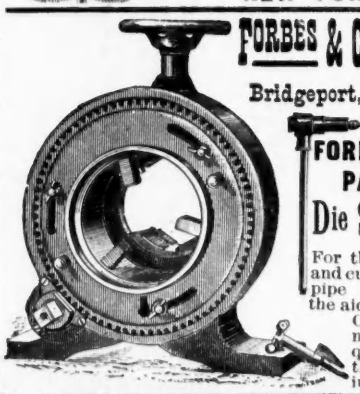
Has seamless drawn brass tubes. The U shape of the tube prevents their being affected by expansion or contraction.

This Heater has been in constant use Ten Years.

None have ever required repairs. Gives the highest results attainable by the use of exhaust steam.

IT IS ALSO THE ONLY HEATER APPLICABLE TO CONDENSING ENGINES, increasing the vacuum and imparting a high degree of heat to the Feed Water.

Benjamin F. Kelley, AGENT, No. 91 Liberty St., NEW YORK.



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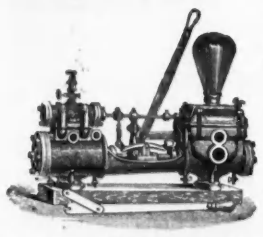
M'f'r's of FORBES' PATENT Die Stocks,

For threading and cutting off pipe without the aid of vise. Only one man required to thread 6 in. pipe.

KNOWLES PATENT STEAM PUMPS.

THE STANDARD!



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Estimates furnished on application for Pumping Machinery of any capacity, and to work against any pressure.

Air Pumps and Condensers for Steam Engines a specialty. Will save from 20 to 30 per cent. fuel.

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COOKE & CO., DEALERS IN Machinery and Supplies, 22 CORTLANDT ST., NEW YORK.

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The Waters Perfect Governor.

Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also

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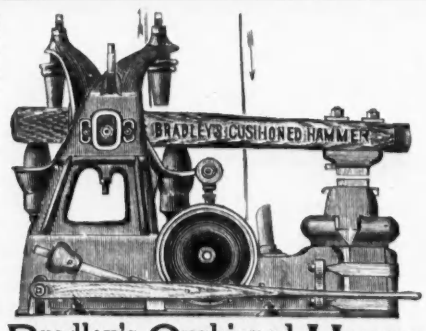


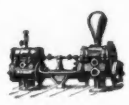
Bradley's Cushioned Hammer

Stands to-day WITHOUT AN EQUAL.

OVER 800 IN USE.

BRADLEY & CO., Syracuse, N. Y.

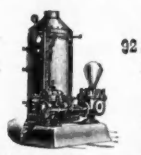
ESTABLISHED IN 1832.



The Deane Steam Pump Co.

HOLYOKE, MASS.

Send for new Illustrated Catalogue.



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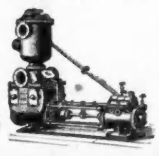

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UNION STONE COMPANY,

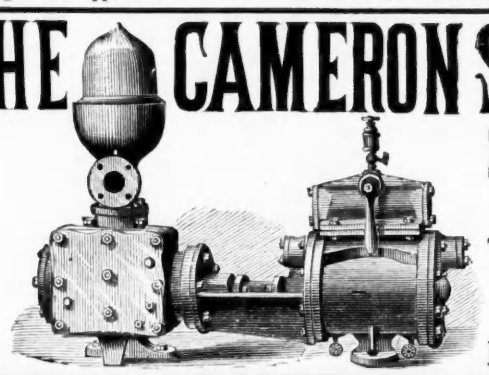
Patentees and Manufacturers OF THE

UNION EMERY WHEEL.

EMERY, EMERY WHEEL MACHINERY AND TOOLS A SPECIALTY.

Automatic Knife Grinding Machines, Wood Polishing Wheels, Grinders' and Polishers' Supplies. Catalogues on application. 38 AND 40 HAWLEY STREET, BOSTON, MASS.

THE CAMERON STEAM PUMP.



Is the Standard of Excellence AT HOME AND ABROAD.

THE A. S. CAMERON Steam Pump Works, Foot of East 23d St., NEW YORK.

THE HERCULES TURBINE

Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.

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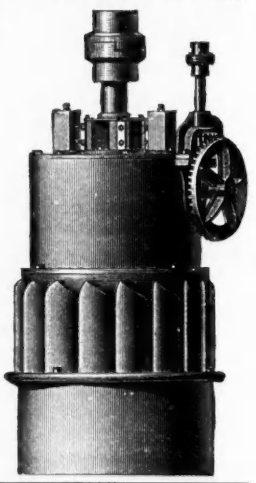

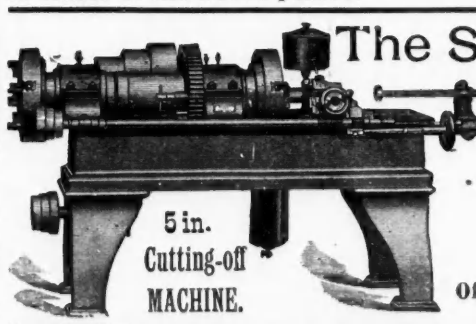

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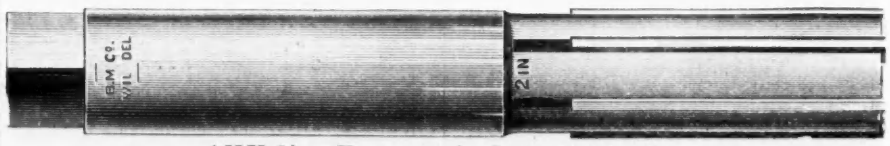

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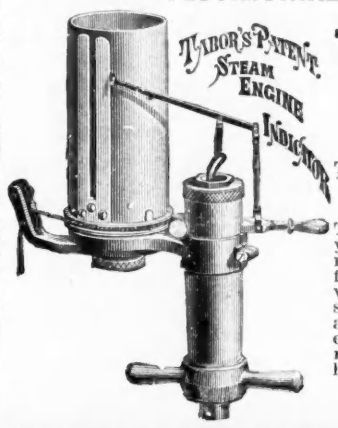

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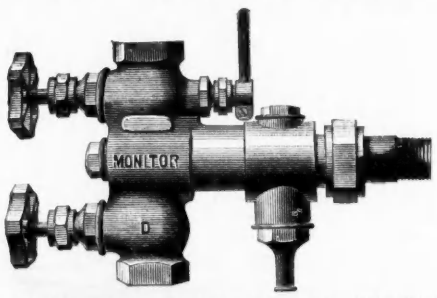

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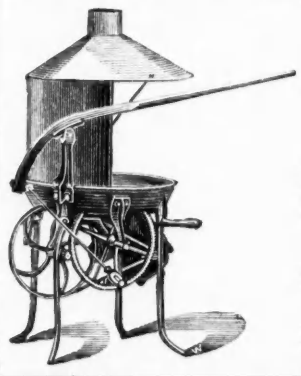

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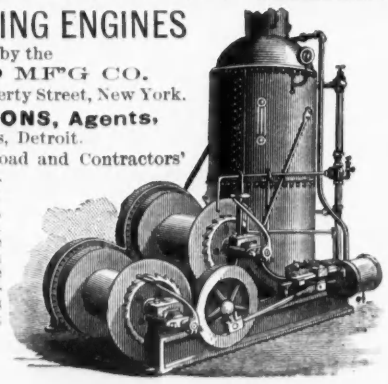

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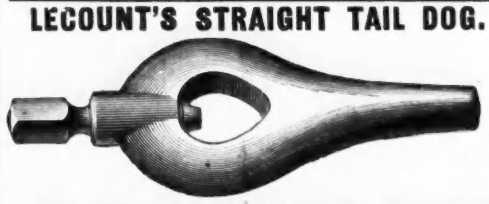

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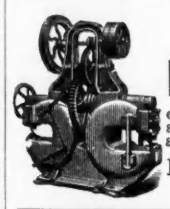

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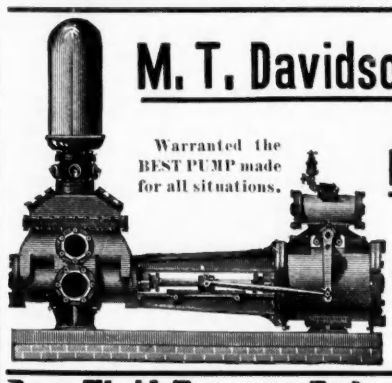

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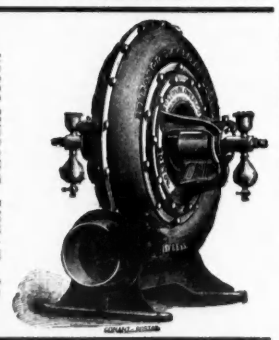

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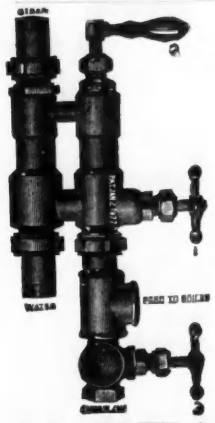

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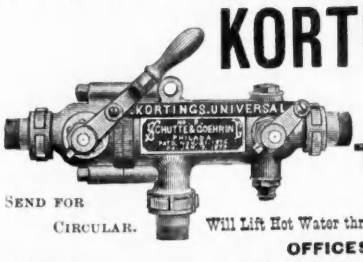

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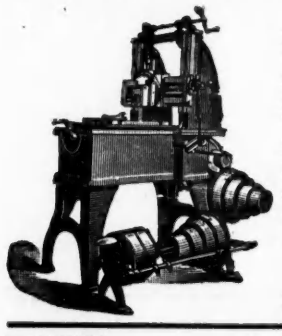

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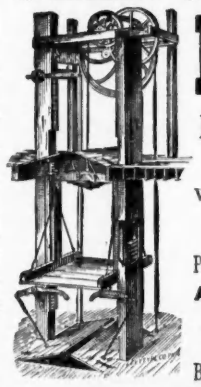

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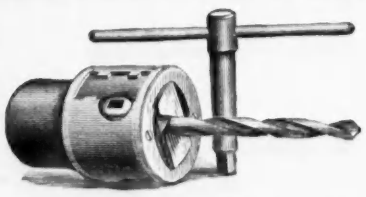

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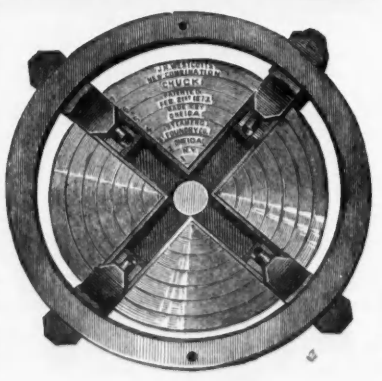

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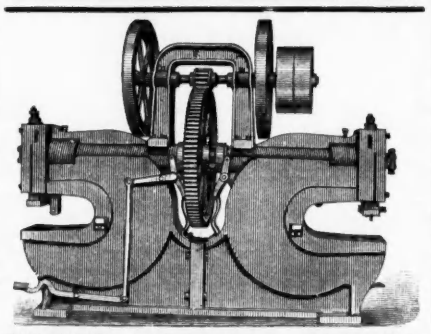

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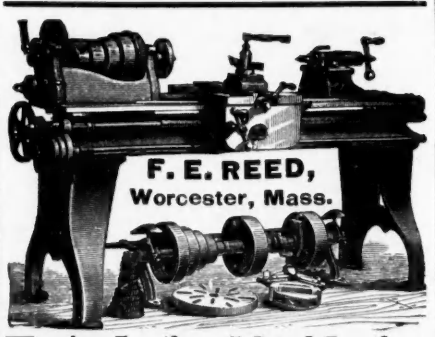

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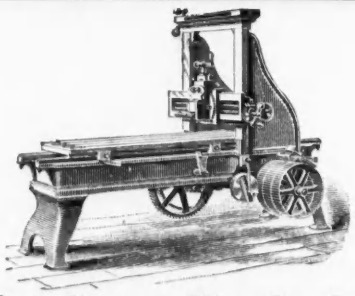

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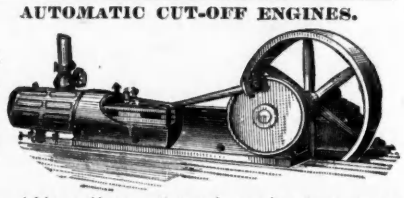

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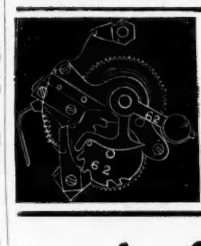

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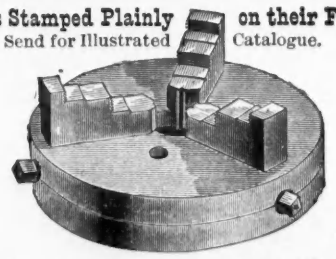

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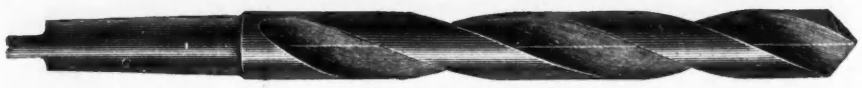

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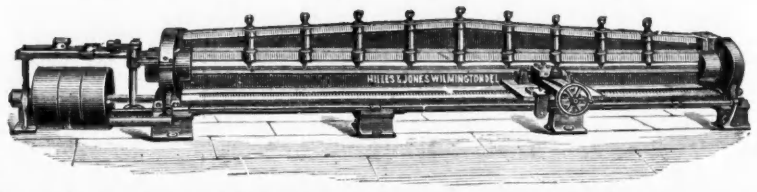

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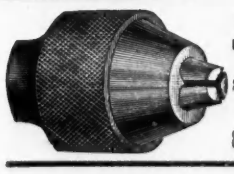

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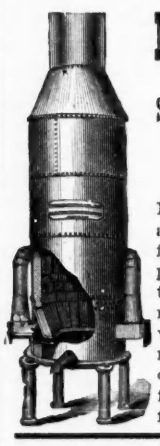

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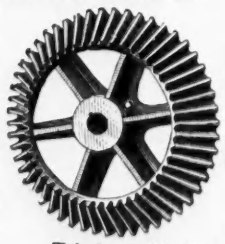

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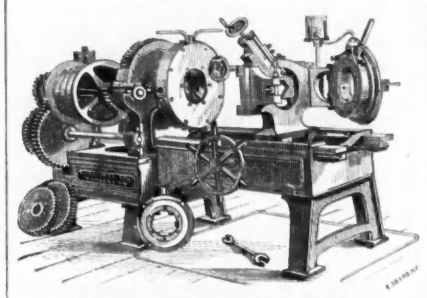

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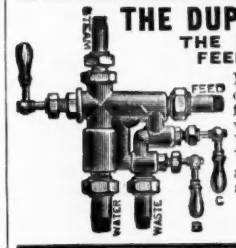

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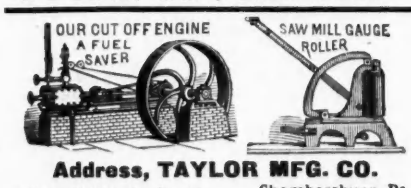

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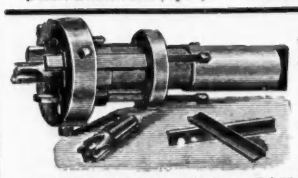

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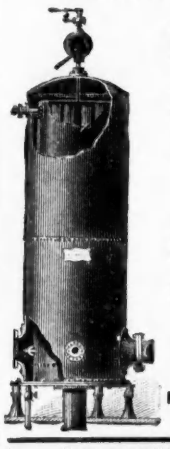

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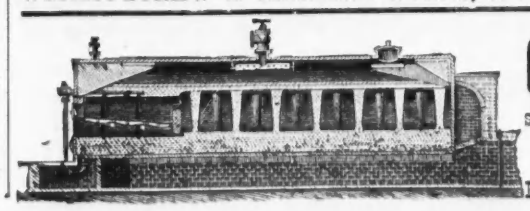

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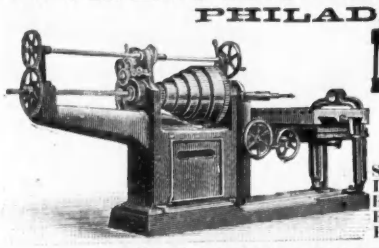

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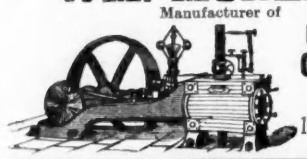

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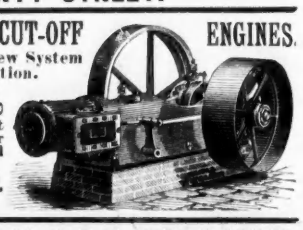

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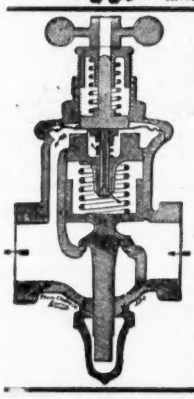

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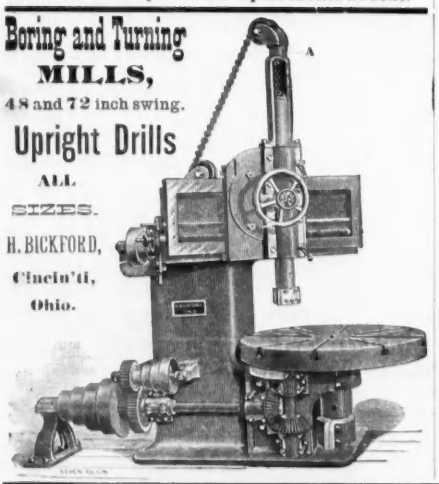

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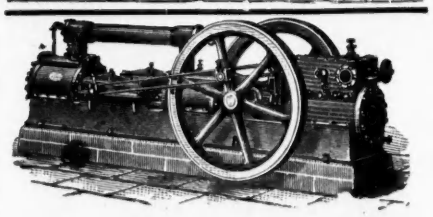

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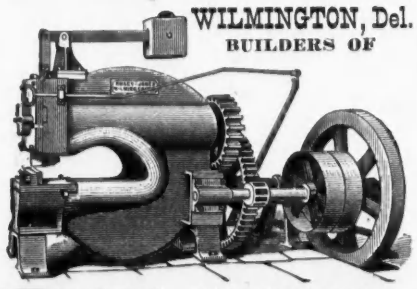

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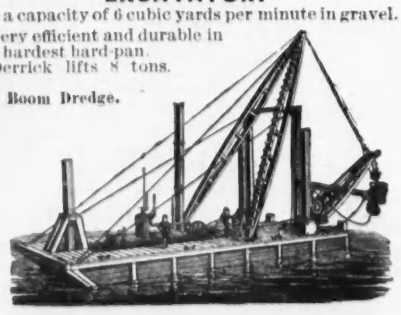

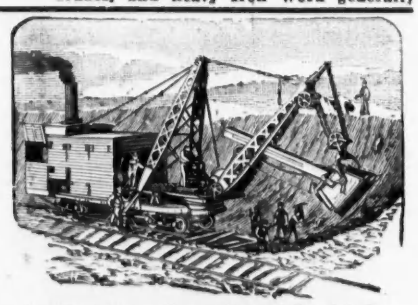

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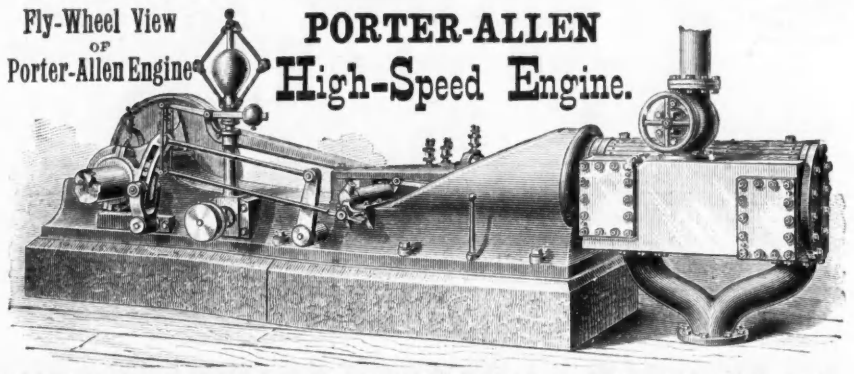

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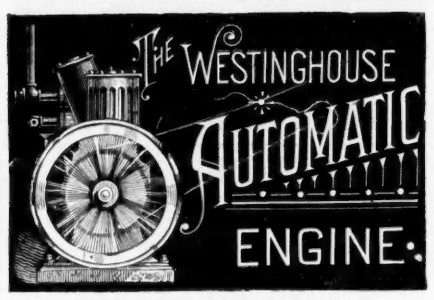

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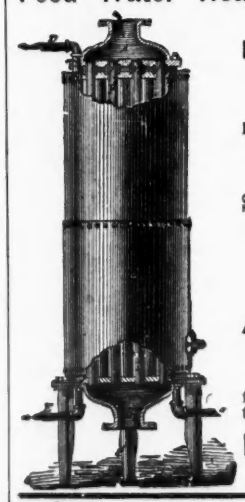

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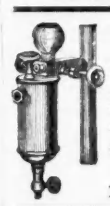

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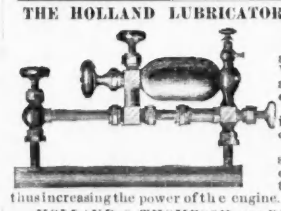

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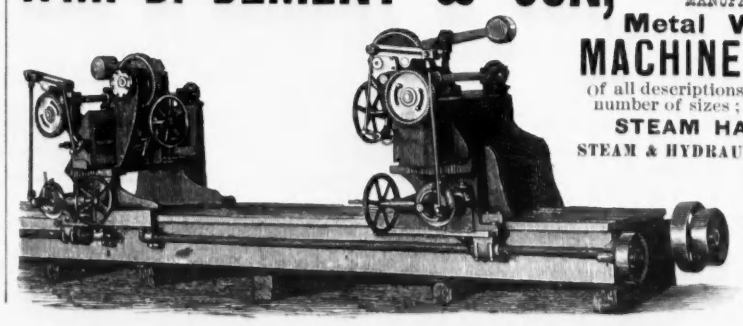

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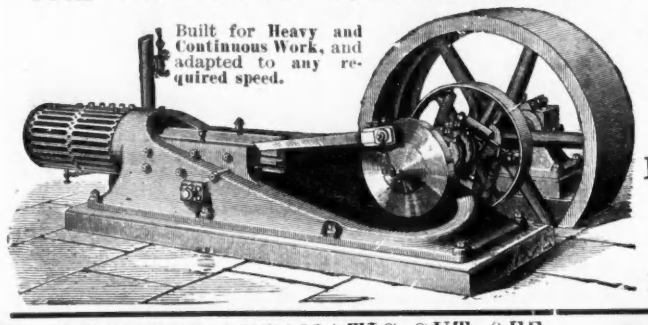

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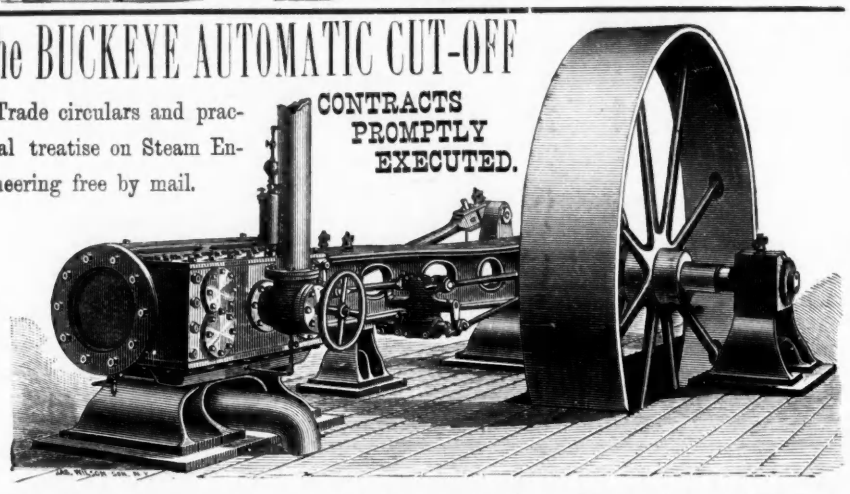

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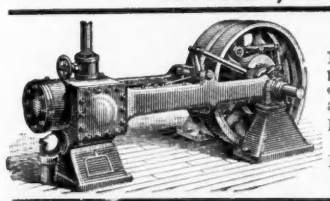

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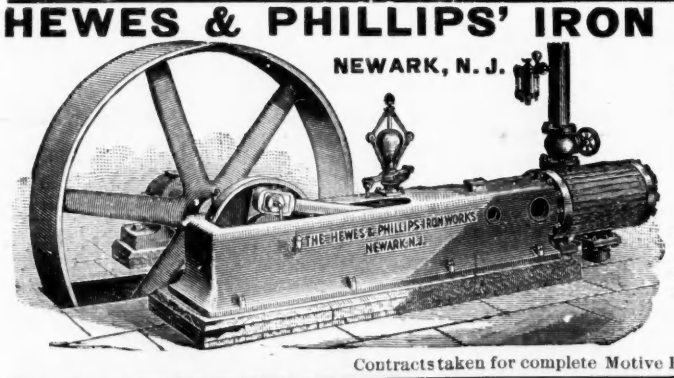

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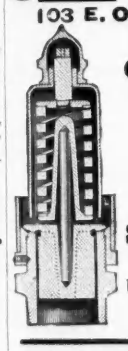

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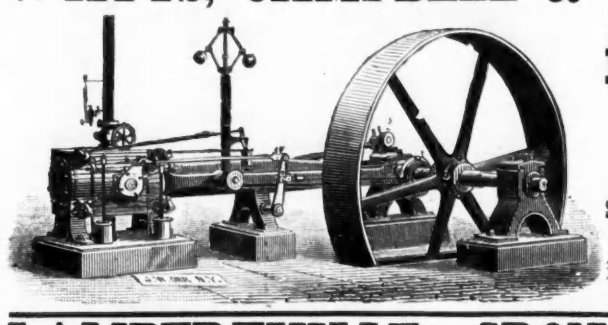

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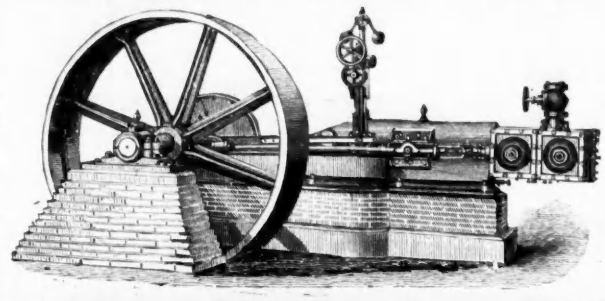

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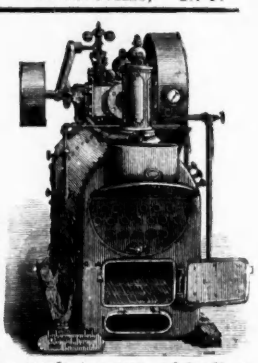

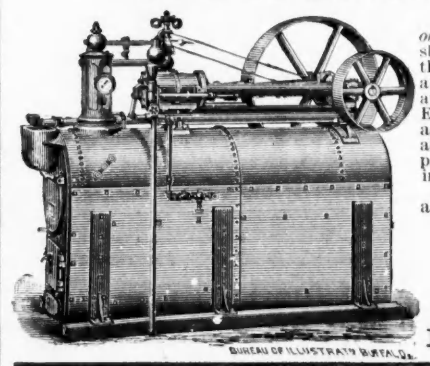

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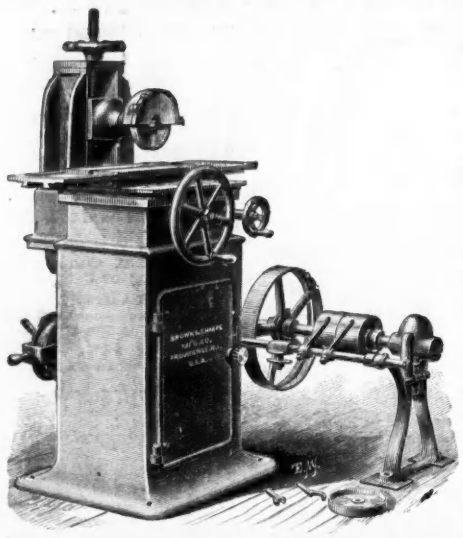

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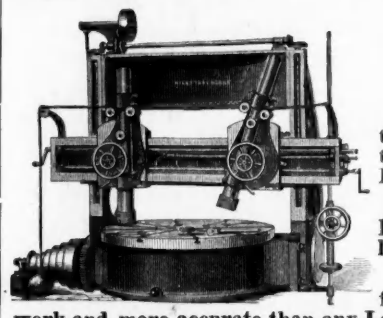

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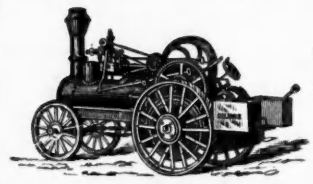

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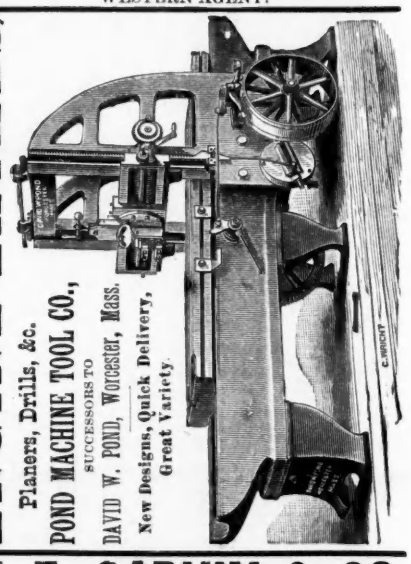

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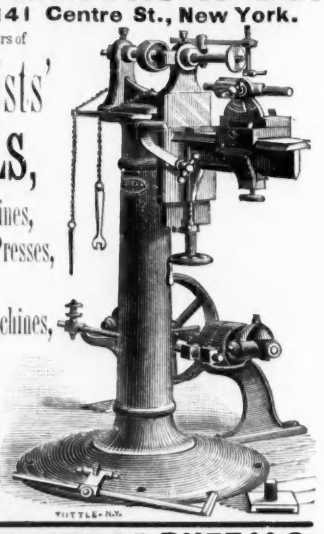

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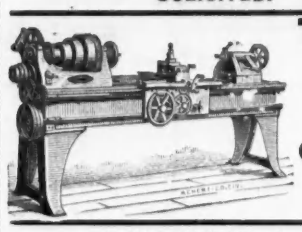

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